Ideation reference process model for the early phase of innovation

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Processus d'idéation de référence pour la phase amont de l'innovation – Ideation Reference Process Model for the Early Phase of Innovation

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List of Abbreviations and Symbols

A1-5	Action No. 1-5
AD	Advanced Development
ADP	Advanced Development Process
AE	Advanced Engineering
AG	Public company (abbreviation of German "Aktiengesellschaft")
Art.	Article
ASME	American Society of Mechanical Engineers
B2B	Business to Business
BF Germany	Burkert Fahrzeugteile Germany
BVW	Corporate Suggestion System (abbreviation of German "Betriebliches Vorschlagswesen")
CEO	Chief Executive Officer
cf.	Compare (abbreviation of Latin "confer")
CIRP	The International Academy for Production Engineering (abbreviation of French "College International pour la Recherche en Productique")
CO_2	Carbon dioxide
COM	Commission
CPAS	Comparative Performance Assessment Study
CT	Computer Axial Tomography
CTO	Chief Technical Officer
DIB	Deutsches Institut für Betriebswirtschaft
DOI	Digital Object Identifier
DUV	German University Publishers (abbreviation of German "Deutscher Universitäts-Verlag")
e.g.	For example (abbreviation of Latin "exempli gratia")
Ed.	Editor

EDI	Electronic Data Interchange
Eds.	Editors
EGR	Exhaust gas recirculation
EIASM	European Institute for Advanced Studies in Management
EMI	Electric and Musical Industries Ltd.
E-Mobility	Electro-mobility
et al.	And others (abbreviation of Latin “et alli”)
etc.	And so forth (abbreviation of Latin “et cetera”)
EU	European Union
EUR	Euro
EuroSPI^2	European System & Software Process Improvement and Innovation
FEV	Forschungsgesellschaft für Energietechnik und Verbrennungsmotoren
FFE	Fuzzy front-end
GE	General Electric
GmbH	Limited company (abbreviation of German “Gesellschaft mit beschränkter Haftung”)
GWV	Gabler Verlag, Westdeutscher Verlag and Vieweg Verlag
i.e.	That is (abbreviation of Latin “id est”)
IATF	International Automotive Task Force
IEEE	Institute of Electrical and Electronics Engineers
IESE	Institute of Higher Business Studies or International Graduate School of Management (abbreviation of Spanish “Instituto de Estudios Superiores de la Empresa”)
Inc.	Incorporated
INSEAD	Institut Européen d'Administration des Affaires
IP	Ideation Process
IP	Intellectual Property
IRI/CIMS	Industrial Research Institute/Center for Innovation Management Studies
ISF	Innovation Strategy Framework
ISPIM	International Society for Professional Innovation Management
ISQI	International Software Quality Institute
Iss.	Issue

IT	Information Technology
JPB	Jeffrey Paul Baumgartner
KSPG	Kolbenschmidt Pierburg
LCE	Life Cycle Engineering
Ltd.	Private company limited by shares
MIT	Massachusetts Institute of Technology
n	Sample size
NCD	New Concept Development
NCR	National Cash Register
No.	Number
NPD	New Product Development
OEM	Original Equipment Manufacturers
PDMA	Product Development and Management Association
PDP	Product Development Process
PPT	Pierburg Pump Technology
R&D	Research and Development
S1-6	Success Factor No. 1-6
SAM	Society for Advancement of Management
SAPPHO	Scientific Activity Predictor from Patterns with Heuristic Origins
SME	Small and medium sized enterprises
SMMT	Society of Motor Manufacturers & Traders
SOQRATES	Software Quality Rates for Maturity
SPICE	Software Process Improvement and Capability Determination
TRIZ	Theory of Inventive Problem Solving (abbreviation of Russian “Teoria reschenija isobretatjelskich sadatsch”)
VDA	German Association of the Automotive Industry (abbreviation of German “Verband Deutscher Automobilindustrie”)
VoC	Voice of the Customer
Vol.	Volume
vs.	Versus
zfwu	Zeitschrift für Wirtschafts- und Unternehmensethik

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1 Introduction

1.1 Initial Situation

The obligation to create innovations is inevitable to survive in business. Companies operate today, more than ever before, in a very competing and complex environment with rapidly changing market conditions. Thus, to play an important role in the global market, it is necessary to increase the capacity of innovations and combine customer needs, productivity and competitiveness in the development of new products, services or business models. This especially applies to companies that obtain their competitive advantages by technological lead. Intrinsically, these companies are highly dependent on the evolution of the importance of different technologies on the market. Therefore, they are obliged to predict product strategies and technologies that guarantee their continuous growth.

The automotive industry is one such sector. Consumer demands for comfort, safety, fuel economy, etc., as well as international competition, and environmental standards and regulations are the most important drivers of automotive innovations. Original Equipment Manufacturers (OEM) and suppliers have to innovate offensively to contend against this innovation pressure. A fast reaction to this pressure to innovate is of crucial importance.

Consequently, OEMs and suppliers pay increasing attention to the deployment of innovation management systems that focus on efficient and effective idea generation, conversion, and diffusion. Particularly, the generation of ideas and their capitalisation aspect are the decisive factors in this context. Innovation management has to guarantee a holistic idea generation and selection to support the company's New Product Development (NPD) process with the continuous flow and collection of new successful ideas in order to achieve and maintain the reputation of a highly dynamic and innovative actor on the market.

Within the entire innovation process, composed of the so-called Fuzzy Front-End (FFE), the NPD and the commercialisation [KOE2002], idea generation and selection happens in the early and often unstructured phase of innovation.

We want to introduce the term "ideation" for this central task of innovation management (see Chapter 3) and emphasise the fact that the management of ideas in this FFE is a very challenging mission for innovation management because of the main characteristics of this crucial phase: uncertainty, ambiguity and dependency on individual and collective performances.

1.2 Research Problem

What makes the front-end of innovation so important for innovation management? – The answer can be seen in the fact that decisions made in the front-end largely determine not only the outcome of the innovation process—the innovations—but also the involved costs, time frame and the resources needed for conducting the process [BRÖ2004] and [MIC2006a]. Hence, the quality of ideas generated and the effectiveness of the evaluation methods to choose the "right" ideas in the front-end largely influence the subsequent stages of NPD and commercialisation.

Nowadays, numerous companies assume that they do not tap their full innovation potential. These organisations are sure that their current innovation power is not enough to guarantee long-term market success because they fail to master the initial phase of their innovation activities in an optimal manner. So they stress the need that innovation management has to act more systemically and systematically to close gaps between the actual innovation creation and the previously described possibilities of improvement. Thus, innovation management has to find a way to organise the FFE, the pre-phase of the NPD, that more successful ideas are generated, selected and finally transferred to the NPD.

With the identification of its overall importance for the innovation process, the front-end of innovation has become a focus area of innovation management in terms of capitalising on the opportunities of structuring and improving this extremely complex phase. Such improvement opportunities are mainly situated in the following research fields of current innovation literature: the impulses for ideas [BRE2009], the internal and external sources of ideas [CAL2004], the organisational culture and strategy to leverage ideas [POS2009], or the evaluation of ideas [POS2011].

Research in innovation management, FFE or NPD mainly deals with aspects of the selection and implementation of ideas. However, the topic of an ideation process for the generation, maturation, and selection of ideas that companies can practically implement is still largely untreated. Especially Khurana and Rosenthal emphasise the need for further research in this field [KHU1998]. Forced by innovation pressure, companies need to know how they can optimise

their ideation to positively influence the following phases of the whole innovation process. This work attempts to give a significant contribution to fill this gap.

1.3 Motivation

The motivation driving this work is the author's practical experience in his function as innovation manager of the German automotive supplier KSPG Automotive Group, formerly named Kolbenschmidt Pierburg, and denoted "KSPG" in this thesis.

The analysis of the existing innovation management system at KSPG revealed that

1. currently at KSPG ideation consists of the collection of ideas rather than their generation, and
2. idea generation is limited to a core group of employees who act as idea contributors [NEU2011b].

This situation represents a threat of idea stagnation. This is why the company's top management has declared the improvement of idea generation and selection as one of its major strategic objectives. Because of KSPG's process-oriented corporate culture, a practicable ideation process should be the output of this research work. The study "Car Innovation 2015" [DAN2007], which will be explained in more detail in the upcoming Chapter 6.2.2, proves the fact that the scenario at KSPG addresses a general problem of companies in the sector of automotive supplier industry.

From our point of view, the principal motivation factors for the creation of an ideation process can be summarised as follows:

- Ideation should run in a structured way to make the FFE of innovation clearer.
- The systematic management of ideation supports decision-makers within the organisation.
- In the company, actors who are responsible for innovation management have an important role in the active generation of ideas.
- The accompanying development of an innovative organisational culture motivates employees and supports the generation of ideas.

- The definition of an evaluation scheme that allows monitoring ideas and rating their commercial success levers the transfer rate of promising ideas from the ideation process to the following NPD process.

1.4 Scope

This thesis focuses on idea generation and selection for innovations of products, services or business models with commercialisation potential on the market, which is denoted as "ideation" henceforth. This focus, which will be clearly explained in Chapter 3.1, allows a well-founded differentiation with respect to closely related fields that are not examined in this research work, like corporate suggestion systems and its further development as continuous improvement process (Kaizen).

Based on the author's background and professional situation and experience, this work focuses on the Western automotive supplier sector with its process-oriented corporate culture and professional environment [DEH2007]. Thus, the main interest lies on the creation of a process-related model of ideation management. The methodological approach is coined by a complementary mixture of scientific literature study and practical qualitative research, mainly in the form of expert interviews and capitalisation of feedback from practical implementation at KSPG as case study.

1.5 Thesis Structure

The main structure of the thesis is shown in Figure 1-1. It is composed of the following four main parts:

Part I introduces the state of the art in literature in terms of the most relevant innovation topics for this thesis, namely innovation management and ideation. The focus will be put on key aspects of the early phases of innovation, i.e. the FFE, and the ideation in particular.

Part II specifies the objectives as well as the methodology of this research. As the main research result it proposes a generic approach intended to be used as a guideline and called "ideation reference process model" in this context. It is based on previously during this research identified key success factors from theory and practice. The three main phases of this model will be explained in detail, as well as the related ideation and management activities and tools.

Part III derives a specific ideation process suitable for KSPG from the reference process model developed in Part II, and the envisaged actions of its

introduction in the corporate organisation will be proposed. Throughout this process, the relevance and feasibility of the elaborated ideation reference process model will be validated, and the latter improved accordingly.

Part IV draws the conclusion of this thesis and gives several perspectives for future research activities.

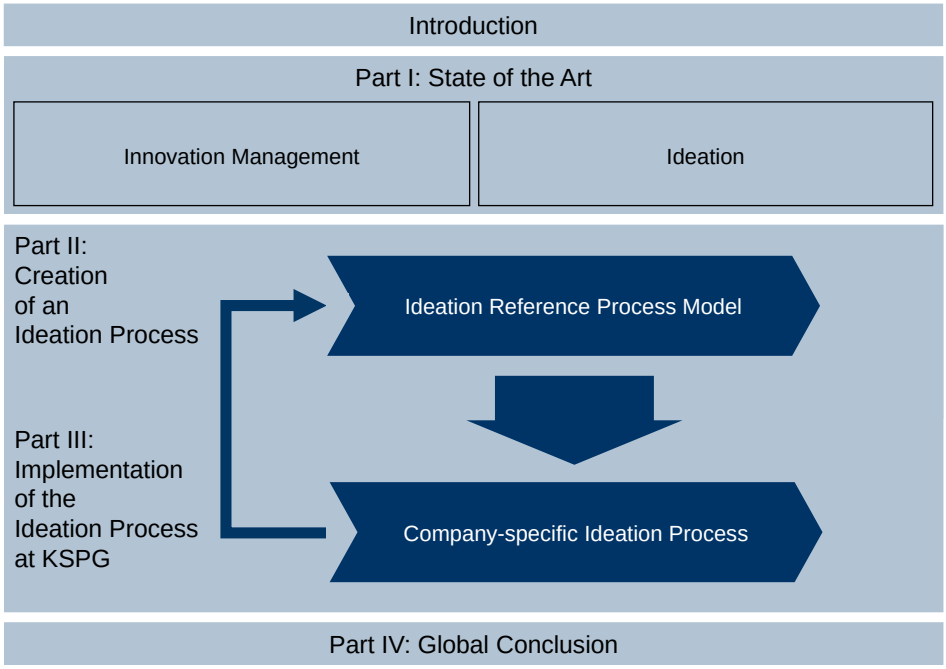

Figure 1-1: Structure of this Thesis

Part I:

State of the Art

2 Innovation Management

2.1 The Definition of Innovation

The European Commission sees innovation as the core of entrepreneurial initiative: Almost any company owes its foundation, at least in relation to its competitors on the market, to an innovation [EUR1995]. Innovations are the global motor for economic growth and represent at the same time the key factor for more competitiveness [VIV2008].

However, technical progress alone is not sufficient in order to innovate with long-time success. Innovation also means predicting market needs, offering better quality and/or additional services, organising efficiently, meeting deadlines and controlling costs [EUR1995]. So the term innovation becomes more and more a widely spread phenomenon and instrument. It represents an answer to continuous technical, economic, ecologic, social and political changes [BRU1999], [COO1994], [MEF1998], [THO1980], [LLE2011].

Joseph Alois Schumpeter is considered to be one of the founders of modern innovation research. Already in the year 1911 he wrote his book "Theorie der wirtschaftlichen Entwicklung" [SCH2002]. In 1934 this major work was published in the United States as "The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle", where he writes about the realisation of new combinations by "the doing of new things or the doing of things that are already done, in a new way" [SCH1982]. Thus he made innovation—without using the term innovation explicitly—to a subject of economic research. Based on this fact, innovation research can look back on a long history of scientific interest. At the same time, innovation still describes one of the most important management tasks [SCH2005].

Since innovation has found its way into the economic context, numerous authors created further—partially deviating—definitions and interpretations of the term innovation. This lack of a generally accepted and consistent definition of the term innovation is mainly due to the different dimensions which innovations can affect [SCH2005]. Most approaches have the criteria "new"

and “change” in common that are reflected in the definition of Everett M. Rogers: “Innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption” [ROG2003]. This definition from Rogers implies that an innovation is more than an idea [RIE2009a]. In his eyes, an “innovation is concerned with the process of commercialising or extracting value from ideas”. This definition agrees with the general opinion in NPD research [KOE2001], [KOE2002]. In Chapter 3 we will explain this point more precisely.

Nevertheless, almost every innovation starts with an idea [BUL2008], and there are two major impulses for innovation: market pull and technology push [BRE2009]. Koen et al. see in an idea “the most embryonic form of a new product or service. It often consists a high-level view of the solution envisioned for the problem identified” [KOE2002]. This can finally be manifested as “an explicit description of an invention or problem solution with the intention of implementation” [RIE2009a]. In the further course of our work we will refer to this central concept of an idea.

In this context, the distinction between invention and innovation is important: while invention describes the first technical realisation of a new problem solution developed as a result of research activities and leads to a legal basis for utilisation of the results (for example in the form of patents), the term innovation implies also the utilisation, integration and marketing of new solutions in usable products and services, going beyond the actual invention. R&D is the basis for the development of innovations. It covers a set of specific processes that are created to gain knowledge and to discover new technical solutions to a problem [PLE1996], [SPE1996], [STO2001].

Intellectual property plays a major role in a technology-driven business environment like the automotive industry because it fulfils three main functions [SIM2001]:

- Protection of price and market share by excluding others from a specific marketplace;
- insurance against legal action by other patent holders to mitigate risk of infringement and
- financial asset in strategic alliances, in which technology is licensed, swapped, assigned, mortgaged, or held as a blocking strategy.

The following Figure 2-1 shows a generalised picture of the relationship between patenting, invention and innovation on the basis of Blasberg’s research work [BAS1987].

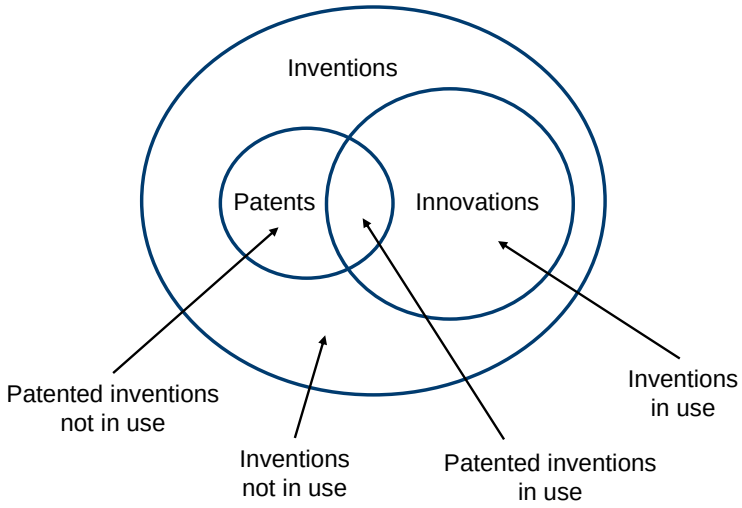

Figure 2-1: Distinction between Patent, Invention and Innovation [BAS1987]

This explanation makes the position clear that innovation is not to be confused with the term invention [PLE1996], [NAG1993], [SPE1996] and [STO2001].

Koen et al. have proven the fact that a common language and vocabulary in the field of NPD research, especially in the front-end of the NPD process, is a vital prerequisite to define the front-end of the innovation process and to bring clarity and rationality in the management of this front-end [KOE2001]. To this aim, we want to define the important term "opportunity", according to Koen et al. as "a business or technology gap, that a company or individual realises, that exists between the current situation and an envisioned future in order to capture competitive advantage, respond to a threat, solve a problem or ameliorate a difficulty" [KOE2002].

2.2 The Dimensions of Innovation

Although innovation is a very complex topic there is a consistent comprehension about the dimensions describing innovation. Hauschildt and Salomo define four dimensions for describing the types of innovation [HAU2011]:

1. Content dimension: What is new and what is the extent of the novelty?
2. Subjectivity dimension: For whom is it new?
3. Process dimension: Where does the novelty start and where does it end?
4. Normative dimension: Does new means successful?

2.2.1 Content Dimension

Following Hauschildt and Salomo, the objects of development and innovation activities are primarily products and processes [HAU2011]. Product innovation refers to the new or improved product, equipment or service that is successful on the market [EUR1995]. The main aim of a product innovation is to implement its function in a more effective way than before. A new combination of factors to make the manufacturing of a product more competitive, increase the quality and safety levels, reduce time to market etc. is characteristic for process innovations, the increase of efficiency being the main intension [HAU2011]. Due to the ambiguous meaning of innovation, which can denote both a process and its results, it is difficult to distinguish between product and process innovations very strictly. Products and processes are mutually dependent and partly complement each other [HAU2011].

The second aspect of this dimension of innovation is the degree of novelty, i.e. the extent of innovation. Based on this typology, which is mainly used in the technological context, there is a differentiation between radical and incremental innovation [PLE1996], [SNE1994]. A radical innovation means a breakthrough typically originating from R&D, while incremental innovation modifies the products, processes or services through successive improvements [EUR1995].

Chandy and Tellis expand this typology of innovations: Their review of the literature leads them to the assumption that there are two dimensions underlying most of the definitions of innovation [CHA1998]:

1. *Technology:* Extent to which the technology involved in a new product is different from prior technologies, and
2. *Markets:* Extent to which the new product fulfils key customer needs better than existing products (on a per-dollar basis).

This finding allows them to distinguish four types of innovation [CHA1998]:

a) *Incremental Innovation:* Low technology changes and low customer benefits per dollar,

b) *Technological Breakthrough:* A substantially different technology but low customer benefits per dollar,

c) *Market Breakthrough:* Based on core technology similar to existing products but high customer benefits per dollar, and

d) *Radical Innovation:* High technology change and high customer benefits per dollar, relative to existing products.

These different types of innovations have a crucial dynamic that can be visualised as a series of S-curves of technological innovation as shown in Figure 2-2.

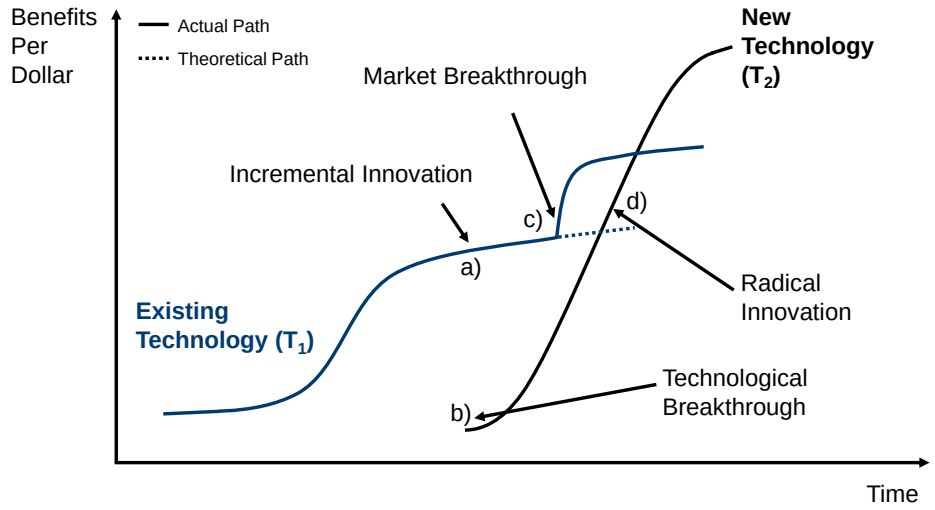

Figure 2-2: Types of Innovation according to Chandy and Tellis [CHA1998]

Product innovations reflect a change in the end-product or service of a firm [CAR2003]. They can be incremental or radical in nature that depends on their degree of newness [HAU2011]. While incremental product innovations improve the existing functional capabilities by means of small-scale improvements in value-adding attributes like performance, safety, quality and cost, radical product innovations contain concepts that differ significantly from further products [CAR2003].

2.2.2 Subjectivity Dimension

A major problem with the identification of the degree of novelty of an innovation is the aspect: for whom is a product new? This question plays an important role: Not the implementation of technological changes is of crucial importance, but the awareness of a subject to recognize these changes as innovation [HAU2011] and [THO1980].

The subjective awareness and evaluation of innovations occurs basically in two different ways [WIT1973]:

- *The market perspective:* Is a product already represented in a relevant Market in similar form or not?

- *The entrepreneurial perspective:* Companies can talk about innovations when they use the novelty the first time independent of whether other companies have already used it before.

2.2.3 Process Dimension

Innovation also means the process of the development of new products and procedures and represents the result of all thereby connected innovations, which have been developed until then [GER1976]. Furthermore, an innovation does not occur to a determined moment, but is the result of a more or less extensive sequence of content wise connected activities [VAH1999]. These process steps can run partly in parallel and can be repeated if necessary [HAU2011], [PLE1996] and [THO1980]. Depending on its design and definition, this developing process includes activities from the idea identification up to the market launch and the usage of the new product. In this context, methods of process management are essential to ensure a structured approach in planning, implementation and management during the product development [STA2010].

In literature as well as often in practice, the innovation process is considered as a multi-phase linear and/or iterative process. No consensus exists about the number and the definition of the individual phases [HAU2011], [THO1980], [KLE1996] and [BRE2007].

A simple pattern was developed by Thom [THO1980]. He divides the product development process in the phases of idea generation, idea acceptance and idea realisation. These main stages are further divided into individual sub-phases and/or subtasks. The advantages of this generic model are its adaptability to all types of innovation and the explicit inclusion of a decision phase in the innovation process [STO2001]. Table 2-1 summarises Thom's approach.

Stages of the innovation process		
Main stages		
1. Idea Generation	2. Idea Acceptance	3. Idea Realisation
Specification of the Main Stages		
1.1 Determination of search field	2.1 Testing ideas	3.1 Actual realisation of the new idea
1.2 Finding ideas	2.2 Creation of realisation plans	3.2 Sale of the new idea to the addressee
1.3 Idea suggestion	2.3 Decision to realise a plan	3.3 Acceptance control

Table 2-1: Innovation Process Model by Thom [THO1980] and [BRE2007]

A very recent and comprehensive framework—and one of the most cited papers in the context of modern innovation management [RIE2011]—was developed by Hansen and Birkinshaw [HAN2007], which carries previously released innovation approaches beyond idea realisation to its capitalisation ("idea diffusion"), and is thus investigating the entire so-called Innovation Value Chain.

As depicted in Figure 2-3, Hansen and Birkinshaw recommend viewing innovation as a value chain comprising three phases:

- Idea generation,
- Idea conversion and
- Idea diffusion.

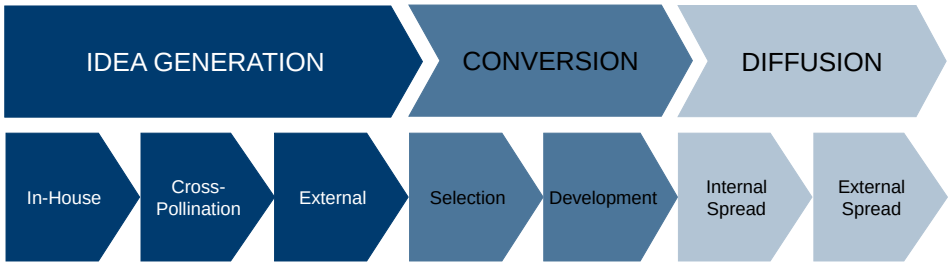

Figure 2-3: The Innovation Value Chain [HAN2007]

Idea generation comprises generating ideas in-house, getting different divisions and units to collaborate to combine knowledge and insight by cross-pollination, and external sourcing to get ideas from outside the organisation.

Idea conversion is composed of selection and development. Selection covers screening and analysing ideas, as well as initiating the funding of ideas. Development is transforming an idea or concept into the required final form.

Finally, idea diffusion involves spreading the idea around the organisation so that the crucial shareholders involved in the market launch and operational activities commit to the idea.

To measure these linked tasks, the authors define key indicators. Because "a company's capacity to innovate is only as good as the weakest link in its innovation value chain" [HAN2007], it is necessary to focus on the right links and avoid weaknesses. Any weak link can break the company's innovation efforts, so the focus has to be set on pinpointing and strengthening the company's deficiencies.

Typical scenarios related to this chain-based perception helps to formulate practically-oriented improvement recommendations, for example:

- To remedy deficiencies lying in idea generation, building external and/or cross-unit networks is recommended.
- Weaknesses in idea conversion can be overcome by creating cross-unit funding and creating safe havens.

Idea diffusion is leveraged by designated "Idea Evangelists", who have the capability and the mission to convince customers and/or development and distribution partners of the idea.

Hansen and Birkinshaw emphasise that there are "no universal solutions for organisations wanting to improve their ability to generate, develop, and disseminate new ideas" [HAN2007]. They argue that boosting a company's innovation strategy by sticking to best practices is not the right way to go. Every company has unique innovation challenges. So another firm's best innovation practice could become another's worst nightmare. They underline the fact that "managers need to take an end-to-end view of their innovation efforts, to pinpoint their particular weakness, and tailor their best practices appropriate to their deficiencies" [HAN2007].

The innovation value chain is a model describing the vital goals in each phase and can be used to analyse how a company's development processes perform in reaching these targets. According to this diagnostic tool of innovation, companies can tune their innovation value chain to the most effective processes. Hansen and Birkinshaw recommend that companies should benchmark and record statistics on each part of their innovation value chain, so they can monitor performance and make specific improvements.

2.2.4 Normative Dimension

Innovation is generally no end in itself but always connected with economic and technical goals and ways of attaining them [STO2001]. The normative dimension describes the evaluation of the economic success of an innovation. Companies develop innovation activities assuming that the results of their R&D positively affect the entrepreneurial success [HAU2011] and [GIE1995]. For this reason, novelty is often associated directly with success [HAU2011] and [GIE1995].

Often the success of an innovation cannot be assessed clearly because it depends on the aims and expectations of the individual user or evaluator. For instance, an innovation will only be valuable to a company, if measurable benefits can be achieved either in terms of revenues, profits or cost reductions [HAU2011]. Despite this restriction a general agreement exists in literature that

innovations have a high strategic importance and a feasibility to influence business success positively [COO2011], [KLE1996].

2.3 The Challenges of Innovation Management

The development of new products is an extremely complex procedure that many companies, despite extensive theoretical findings, control only in a limited way [STO2001]. Product innovations are mainly successful if they are systematically prepared, realised and implemented and they do not happen as a result of pure chance [GRI1997], [PLE1996]. For that purpose it is necessary to create appropriate basic conditions for the innovation activities and to plan, manage and control individual innovation projects in coordination with other innovation activities [STO2001]. These tasks are summarised under the term innovation management.

In the literature there exist many diverging definitions and classifications of the term innovation management. This variety reflects on the one hand the high-contrast nature of innovation management, which is used in the diverse areas of life. On the other hand this diversity can be explained by the different points of view from the scientists and professionals who are concerned with the topic of innovation management, and the factual intellectual and/or value-based cultural attitudes they represent [VON1992]. A uniform terminology or an obligatory definition of innovation development has not been accomplished so far.

Many definitions have in common their ascription to the term “management” which deals in a very comprehensive manner with the planning, organisation, leading and control of economically relevant activities [STO2001], [BRO1998], [VAH1999]. Staehle [STA1999] as well as Hauschildt and Salomo [HAU2011] distinguish management in

- a functional point of view which describes the processes and functions necessary in work-sharing organisations especially the definition of goals and strategies, decision making, the creation and inducement of information flow and the establishment of social relations and
- an institutional perspective which carries out the description and analysis of the functions and roles of the persons and person groups who are involved in management tasks.

Accordingly, innovation management can be defined as the institutional planning and control process of all transactions by persons carrying managerial responsibilities which cover the development and implementation of company’s subjective new products and processes [MEF1998] and [DIL1994]. Therefore the overall mission of innovation management is to manage all innovation

activities to ensure long-term sustainable competitive advantages [PLE1996]. This task description can be divided in the following fundamental functions [HAU2011] and [PLE1996]:

- Creation of a suitable conceptual framework and an innovation stimulating system (e.g. organisational structure and culture) with appropriate social relations.
- Establishment of a process-accompanying and inter-divisional information exchange between all the participants involved in an innovation project.
- Definition of innovation goals and selection of adequate innovation strategies.
- Planning and controlling of individual innovation processes as well as the entire innovation portfolios and the coordination of particular innovation projects.
- Continuing evaluation and decision of innovation projects under economic and technical criteria.

According to one of the most extensive recent European studies named "IMP^{3}rove", it must be taken into account that in a given company these tasks are embedded in a broader influencing context [DIE2006], [ENG2010]. The authors propose a coherent and universal model, which was used as a standard to analyse and assess the innovation processes in more than 1,500 small and medium sized enterprises (SME) from all over Europe.

This model covers all dimensions of innovation management, which are geared to sustainable and profitable growth, and included in A.T. Kearney's "House of Innovation", which is shown in Figure 2-4. The essential building blocks of this house are: 1. innovation strategy, 2. innovation organisation and culture, 3. innovation life-cycle management, and 4. innovation enablers. According to this holistic approach, companies have to continually and systematically manage all of these four dimensions to ensure a steady flow of innovations.

Figure 2-4: A.T. Kearney's House of Innovation [DIE2006], [ENG2010]

Although there were only SMEs involved in this particular study, the elements of the proposed innovation management framework are sufficiently general to be applied equally well to large enterprises. Only their particular challenges are somewhat different [RIE2011].

The *Innovation Strategy* is aligned with business strategy and identifies the most promising areas where the company can achieve higher profit growth rates either with a) new products or services or b) with existing products or service in new markets or c) with new or improved processes or business models.

The company's *Organisation and Culture* have to support this innovation strategy so that the profit growth targets can be reached. Companies must have the structures to drive innovation by e.g. the integration of external partners in their development processes. Their culture must be open to new ideas no matter where they come from. The organisation has to translate the innovation strategy to pursue those ideas that are most promising for their focus areas.

Innovation Life-Cycle Management uses a process that continually develops the capabilities for idea generation, product development, market launch and timely discontinuation of products and services that are no longer profitable. Here leading innovators avoid inefficiencies and ensure short time-to-profit, while the average company might only focus on the time-to-market and forget about proper life-cycle management after the launch of the innovation.

Enabling Factors such as knowledge management, IT- and Human Resource systems, project management, and capabilities in specific technologies or expertise in new market development also have a significant impact on growth through innovation management. They must be associated with the company's innovation strategy, allocated in the right manner in the organisation and leveraged for successful innovation management to fully exploit the growth potential of the innovation.

Because innovation management covers all aspects fostering the innovation capabilities of a company, all of these components must be managed to secure the company's long-term growth. Therefore, these dimensions play a vital role as a guideline for our own research work.

All in all the innovation management is no classical company function. During the last decades, models of innovation have moved from simple linear models towards increasingly complex interactive models [ROT1992]. Due to this change, innovation management has more and more the mission to consider technological, market organisational and institutional dimensions [TID2001], which implies the involvement of not only all responsible members of the company but also external interest groups. These comprehensive and profound interactions with other corporate divisions and the business environment turn the innovation management into a company-wide function with influence on the leadership of the whole corporation [DIL1994] and [PLE1996]. Based on these developments, approaches like Stakeholder Integration [FRE1984] and [FRE2004] and Open Innovation [CHE2003] become more and more important for innovation management.

2.4 Stakeholder Approach

2.4.1 Defining the Stakeholders

Freeman's landmark publications [FRE1984] and [FRE2004] paved the way for the model of market stakeholders into the management literature. Following Freeman's view, stakeholders are defined as "any group or individual who can affect or is affected by the achievement of the organisation's objectives" [FRE1984].

Recently, the stakeholder approach also appears increasingly often in the R&D and innovation management context [ELI2002], [SMI2009]. The basic idea is that not only one group of stakeholders should be responsible for innovations, but also other stakeholders of the corporate environment should be actively involved in the innovation process.

As was shown in research on integrated product and system design [RIE2009b], [RIE2010a], and [RIE2010b], integrating stakeholders of the complete product/system life cycle throughout the entire product/system development process from the earliest phases on is a key to creating sustainable innovation. The sustainability aspect is leveraged by the fact that only the integration of different views on the product/system in terms of its functions and its economic, ecologic, and social environment allows to identify requirements and constraints on the product/system in a holistic manner, and therefore to take them into account both in the composition of development teams, as well as in the design and architecture of the product/system [ZWO2007]. The same issue applies to idea generation and assessment, which is part of the earliest upfront phases in the product/system life cycle.

Consequently, for innovation management it is essential to identify potential innovative stakeholders inside and outside the organisation. However, as there is no unique grouping of related stakeholders, concepts from social science help clustering stakeholders. In integrated design, Mer et al. [MER1997] proposes groups ("worlds") of stakeholders which share

1. *Logic of Action:* stakeholders expose and contribute what is essential for them.
2. *Scale of Value:* means to measure and understanding of the value contribution.
3. *Collective Knowledge:* knowledge that is shared among different worlds.

The essential consideration here is that the integration of these stakeholder worlds in the innovation management process is a key step for making innovation sustainable, as it allows taking into account the requirements and constraints imposed by the different actors of the product/system life cycle [SAU2010]. A large number of diverse internal and external stakeholders of a company should take active parts in the whole innovation management process [CLE2007]. Thus innovation becomes a team-based effort that involves alliances with all internal and external partners [COO2006b].

The added value created by the integration of stakeholders has often been ignored in the decision-making process when seeking to improve innovation performance. Hansen and Birkinshaw found that in diffusion-poor companies, decisions about market launch are made mostly locally, and "not-invented-here thinking" [KAT1982] dominates the decision process [HAN2007]. Many decision-makers do not completely understand the potential benefit of the value added by stakeholders. Stakeholders not only affect the survival and development of enterprises, but also determine the activities and effectiveness of enterprise's technology innovation. Research results indicate that internal and external stakeholders actually affect development and effectiveness of

enterprise technology innovation [SCH2006]. At different stages of the innovation process, the mode and degree of effects from stakeholder involvement are different. Stakeholders have different benefit requests and different realisation approaches to the whole innovation management process. These differences require a detailed analysis of the stakeholders.

2.4.2 Managing the Stakeholders

The management of the stakeholders begins with understanding them. Therefore, the analysis of the stakeholders is essential. Only through the analysis and the thereby gained insights it is possible to organise the stakeholders and coordinate the innovation activities they are concerned with. Furthermore, this kind of analysis is compulsory for innovation projects to gain more validation and significance [ELI2002], [STE2009]. The core questions which such a stakeholder analysis should answer are the following:

- Who are the stakeholders involved in innovation management?
- What are the interests and value systems of the stakeholders?
- What are the stakeholders' roles and how can their influence been rated?
- What kind of transactions and interdependencies exist with and between the stakeholders? Are there any conflicts or critical success factors?
- Which methods and tools have to be found that facilitate the systematic involvement of these stakeholders to obtain sustainable improvement in innovation development?

With these questions a company has the opportunity to survey its stakeholders. For internal and external stakeholders this guideline can be used to gain insights about their contribution to innovations.

In particular, employees are highly cited as sources of ideas [STA1992], [BEL2004], [ALA2003]. This confirms the presumption that internal stakeholders have a major impact on the early stage of the innovation process. The important role of the employees throughout the whole innovation process cannot be underestimated, either. The innovative development and the commercial success of the company both depend on the employees' commitments and motivation levels. Parnell and Menefee show that employees may have different perspectives based on their positions that may influence their decision-making [PAR2007]. This leads to the assumption that employees in certain positions may be more likely to come up with new product ideas, while other employees may support the idea selection and idea realisation, depending on their perspectives and duties within the company.

However, the innovation process should not only be based on well-known internal stakeholders. It is a major mistake to think that ideas can only come from inside the company. This error is known as the "Not-Invented-Here (NIH) Syndrome", where companies reject ideas generated outside its walls because they think those ideas are inferior to their own [KAT1982]. The systematic involvement of external stakeholders of the product life cycle in innovation management has huge potential, but demands at the same time a very good understanding of the stakeholders. The multitude and variety of external stakeholder groups potentially involved in this movement is extremely large, and very much driven and supported by increasingly powerful and pervasive networking facilities.

The management and coordination of such networks require specific competencies. Moreover, new metrics have to be found which allow the performance assessment of such innovation networks in terms of several criteria. This is a very important subject of research in management and economy. An exhaustive overview of the state of the art is given in [RAM2010].

There are, however, some intuitive indicators that help in choosing the right strategy and tools to integrate specific groups of stakeholders in the innovation management process. It is evident, for example, that the integration of certain internal stakeholder groups almost requires the positioning of the innovation management towards certain external stakeholders in order to work effectively, e.g.:

- Executives need government and society to build their innovation strategies.
- Management can capitalise on direct contacts with customers, competitors, and suppliers to contribute to innovation management.
- Employees from the sales department can contribute the Voice of the Customer (VoC) to innovation management, identify lead customers, undertake special initiatives to find out about customer satisfaction, wishes, preferences for competitors etc.

For each of these relationships there has to be a dedicated consideration about the process, i.e., the people, methods and tools, which not only enable them, but also motivate the affected stakeholders to contribute with a positive, constructive and fair attitude.

Involving external stakeholders in company-wide innovation management is also the core characteristic of Open Innovation strategies, which have originally been coined by Chesbrough in 2003 [CHE2003]. Both external and internal ideas are used to create value, and internal mechanisms are defined to claim

some portion of that value. Open Innovation assumes that internal ideas can also be taken to market through external channels, outside the current businesses of the firm, to generate additional value. Ideas can also start outside the firm's own labs and can move inside. Open Innovation allows the recovery of overlooked innovations, which increases the chance for projects to create value in a new market or to be combined with other projects. It is thus essential to build up a fundamental understanding in the company for the utilisation of these external stakeholder and the accompanying advantages of this new concept of innovation management, which avoids internal restrictions.

2.5 Open Innovation

In classical industrial organisations, innovation processes have been dominated by the so-called innovation funnel model [COR2005], [HER2007a]. This model is essentially based on the fact that innovation is driven and controlled exclusively by stakeholders that are internal to the organisation. This paradigm can be called Closed Innovation, and it says successful innovations require control. Companies must generate their own ideas and then develop, build, market, distribute, service, finance and support them on their own. It counsels firms to be strongly self-reliant, as it is impossible to be sure of the quality, availability and capability of others' ideas. Consequently, this view also suggests that companies should hire the best and the brightest people, so that the smartest people in their respective industry work for them. Furthermore, intellectual property has to be strictly controlled in order to avoid that competitors can profit from the company's ideas [RIE2011].

In recent years, however, several factors have continued to erode the underpinnings of Closed Innovation. One of them was the growing mobility of highly experienced and skilled people. When people left an organisation, after working there for many years, they took valuable knowledge with them to their new employer. Not only did the new employer win a competent employee at the detriment of its competitor, but also he has never had to pay any compensation to the previous organisation for training that employee. The logic of Closed Innovation was further challenged by the increasingly fast time to market for many products and services, making the shelf life of a particular technology ever shorter. Further, as well, the burgeoning amount of college and post-college training led knowledge to spill out beyond the corporate central research labs to companies of all sizes in many industries [RIE2011].

Beyond that, when fundamental technology breakthroughs occurred, the scientists and engineers who made them were aware of an outside option that they had formerly lacked. If the company that funded these discoveries did not

pursue them in a timely fashion, the scientists and engineers could pursue the breakthroughs on their own in a new start-up firm. Successful companies would not reinvest in new fundamental discoveries but would look outside for another external technology to commercialise [RIE2011]

Open Innovation is the opposed paradigm that assumes firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Both external and internal ideas are used to create value, and internal mechanisms are defined to claim some portion of that value. Open Innovation assumes that internal ideas can also be taken to market through external channels, outside the current businesses of the firm, to generate additional value. Ideas can also start outside the firm's own labs and can move inside. Open Innovation allows the recovery of overlooked innovations, which increases the chance for projects will find value in a new market or be combined with other projects [CHE2003] and [RIE2011].

Open Innovation has been coined by Chesbrough in 2003 [CHE2003], although the paradigm has been around in some industries for a long time. A stereotype example is the Hollywood film industry, which has innovated for years through a network of partnerships and alliances among production studios, directors, talent agencies, actors and scriptwriters [CHE2003]. Many industries are in transition between the two paradigms, e.g., automobiles, biotechnology, pharmaceuticals, healthcare, computers, software, communications, banking, insurance, and consumer packaged goods. The focus of innovation in these industries is moving beyond the confines of the central R&D laboratories of the largest companies to start-ups, universities and other outsiders. In so doing, the company can renew its current business and generate new business, capitalising on abundant distributed knowledge resources [CHE2003].

Chesbrough uses contrasting principles for the distinction between closed and open innovation, based on the following six elements [ILI2010b]:

1. location of expertise,
2. task of own R&D,
3. attitude towards research,
4. endeavour to be first on the market,
5. location of idea generation, and
6. handling of intellectual property.

Table 2-2 opposes the divergent principles of the Closed Innovation approach with the new paradigm of Open Innovation [CHE2003].

Closed Innovation Principles	Open Innovation Principles
The smart people in our field work for us.	Not all the smart people work for us. We need to work with smart people inside *and* outside our company.
To profit from R&D, we must discover it, develop it, and ship it ourselves.	Eternal R&D can create significant value; internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get it to market first.	We don't have to originate the research to profit from it.
The company that gets an innovation to market first will win.	Building a better business model is better than getting to market first.
If we create the most and the best ideas in the industry, we will win.	If we make the best use of internal and external ideas, we will win.
We should control our intellectual property, so that our competitors don't profit from our ideas.	We should profit from others' use of our intellectual property, and we should by others' intellectual property whenever it advances our own business model.

Table 2-2: Contrasting Principles of Closed and Open Innovation [CHE2003]

The Open Innovation paradigm is the basis of more specific derivatives like Coopetition [BEN2000] and Crowdsourcing [HOW2011], and has also become a key concept for tackling the challenges of economic crisis [CHE2009].

2.6 Implications from this Chapter

Innovations are at the centre of technical, economic, ecologic, social and political progress. Therefore, different research disciplines have been focussing on this subject for decades. NPD research emphasises the commercialisation aspect of innovations that allows distinguishing them clearly from inventions. The origin of every innovation, however, is an idea. Consequently, research activities should focus on this topic to influence resulting innovations positively and assure their marketability.

Innovation management organises all the innovation-related tasks and compiles the fundamentals in which innovations can flourish such as the basic enabling factors, innovation life-cycle management, innovation organisation and culture, as well as innovation strategy. A major challenge of innovation management is assuring a continuous flow of ideas to make innovation sustainable. Here the integration of a company's internal and external stakeholders and the organisational and cultural change towards Open Innovation offer today's innovation management potentials to improve their status quo, which should be investigated more deeply.

The complexity of innovation and innovation management is mainly due to its multidimensionality, wherein the process dimension of innovations plays a major role relating to its high impact on a multitude of business actions. During this innovation process, the generation and selection of ideas represents the beginning of all following sub-phases. This process aspect—especially in regard to structuring and managing ideas—represents an area that has not yet been researched exhaustively. This is why we decided to dig deeper into the subject of ideation, as pointed out in the subsequent chapter.

3 Ideation

3.1 Defining Ideation

Ideation represents "the process of generating creative ideas" [MAH2011]. Although it is a portmanteau word that combines the words "idea" and "generation" it has already found its way into the Oxford Dictionary, where it stands for "the formation of ideas or concepts" [OXF2012].

Based on these existing general definitions of the term "ideation", we want to add to this terminology a more precise definition. Within the scope of this research work,

> ***ideation denotes the procedure of idea generation and selection for innovations of products, services or business models with commercialisation potential on the market.***

The aspect of commercial implementation and success on the market is essential for our research work because this is the major characteristic of innovations [KOE2001], [KOE2002]. That excludes ideation for pure internal process innovations or cost efficient organisational new changes within companies. Although radical innovations can imply new processes, process innovations frequently follow the evolutionary product innovation.

Why does such a definition make sense? – There are three major reasons that drive this interpretation of the term "ideation":

1. This definition allows the delimitation from the existing term "idea management", which is nowadays mainly reserved to the subjects of corporate suggestion system and/or the continuous improvement process (Kaizen).
2. Through the term "ideation" and its previous utilisation in literature, the connection to Design Thinking [BRO2008] is more obvious.

3. By using the term “ideation”, the focus on the early phase of innovations—the so-called “fuzzy front-end”—is even more emphasised, and it becomes possible to position “ideation” in the entire innovation process.

These three main aspects concerning ideation will be explained in more detail in the following sections.

3.1.1 Beyond Improving the Company

The utilisation of the term “ideation” allows a well-founded delimitation to the corporate suggestion system, which is nowadays often called “idea management”. Suggestion systems are well-established and have a long history in Europe, America and Asia [SPA1990] and [LLO1999].

The basic concept of suggestion systems is “a formal mechanism which encourages employees to contribute constructive ideas for improving their organisation” [DUN1997]. This fundamental idea is as old as mankind, because social life means to be subject to inevitable change where improvements are necessary [SPA1990].

Thus, the first recorded suggestion system in the West was implemented in 1770, where the leaders of the British Navy realised the need for a reprisal-free process for soliciting frontline information from its sailors [ROB1998]. At that time, the mere mention of an idea that directly contradicted a captain’s or admiral’s opinion was likely to be punished by death.

In the German-speaking countries, Alfred Krupp is deemed to be the founder of corporate suggestion system. In his often cited “Generalreluativ” (German for: “General Regulation”) from 1872, Alfred Krupp asked his employees for improvement suggestions and instructed his superior team to take them gratefully and transfer it to the “Directorium” for examination [RID1998]. So Alfred Krupp already outlined guidelines concerning suggestions, including the submission and evaluation of ideas. He also described how to proceed with declined ideas.

Another often mentioned pioneer of the suggestion system in Europe is William Denny, a Scottish shipbuilder, who asked his workers to suggest methods for building ships at low cost. The William Denney Shipbuilding Company goes down in economic history as first enterprise in Europe, which availed oneself of a suggestion scheme in 1880. It was intended to collect ideas from all employees and to pay a fair reward for each implementable idea [SPA1990], [ROB1998].

In 1892, National Cash Register (NCR) became the first US company to implement a corporate-wide suggestion program. The concept of the 'hundred-

headed brain' was founded by John Patterson, the company's first president. He realised early in his business career that employees had valuable ideas but that management structures tended to prevent these ideas from spreading through the company. Employees complained that there was no point giving ideas to their supervisors as the best ideas were stolen, and the worst ideas used as a pretext for their dismissal [ROB1998].

Many companies around the world follow these successful examples, and especially during World War II and the post-war years, suggestion systems became very popular in the manufacturing sector. After some time of stagnation in the 1960s and 1970s, suggestion systems were reactivated by new optimisation-oriented concepts, like for instance the Japanese approach of continuous improvement processes, called Kaizen [IMA1997], [KOS2011], [BIS2008] and [THO2009]. Over decades of years, suggestion schemes became an integral part of human resource management, with the main aim to motivate employees to contribute their ideas in order to achieve cost, safety and quality improvements [ROB1998], [THO2003] and [THO2009].

Since the 1990s, a number of new approaches developed, including "cross-functional teams" and in German-speaking countries the "Vorgesetztenmodell" (German for: "supervisory model"), so that suggestion systems became more and more a management task. So mainly in Germany, Austria and Switzerland the term "idea management" is used synonymously for the concept of corporate suggestion system, also named employee suggestion system or only suggestion system or scheme [THO2009].

In parallel with the development of the suggestion system towards an idea management system, companies such as Imaginatik and General Ideas Software (now BrightIdea) entered the market in the 1990s, allowing companies to capture and process ideas through dedicated software packages. Such tools allowed managers to configure and run "idea campaigns". In addition to these industry pioneers, a number of further vendors have entered the market, such as JPB (makers of Jenni), Idea Champions (makers of IngenuityBank), and OVO (makers of their Spark and Incubator products) [SHO2006].

Despite these evolutionary changes of the corporate suggestion system and the continuous improvement process, both systems still centre the improvement of the own company. These approaches are employee-oriented, while innovations are dedicated to technological and financial objectives [ZIM1999].

In the context of this thesis, ideation will focus on ideas which are impulses for new activities going beyond organisational improvement. The main characteristics of these ideas are [GLO2011]

- the consistency with the goals of the organisation,

- pro-active behaviour of the initiator,
- overcoming of barriers,
- a long-term orientation [FRE1997],
- multidimensional risk [HAU2011] , [DES2005] and
- market commercialisation potential that leads to a significant value increase for the company and its customers [ILI2009].

Based on this assumption, ideation is not the same like "idea management" because "idea management" is still aligned with improvements of processes in administration and manufacturing. Ideation tries to actively influence the idea generation through individual methods, whereas "idea management", with its institutionalised workflow (e.g. by formal contact point, IT system), the acceptance of the suggestion requires only a passive behaviour of the idea contributor after the submission, because a determined decision-making commission shall administer the evaluation and selection of the implemented activities. In contrast to idea management, ideation introduces ideas that are connected with pro-active convincing and also overcoming of resistances.

3.1.2 Connection to Design Thinking

Reviewing the latest publications that uses the expression „ideation", especially the article by Tim Brown, CEO of the design firm IDEO, from the year 2008 plays a prominent role. IDEO started as a design firm but over the last years it developed itself towards a consulting firm for innovation [HUF2012]. Tim Brown brings the term "Design Thinking" increasingly into business context in his publications [BRO2009]. "Design Thinking", Tim Brown's article in the Harvard Business Review, summarises a methodology which has been coined and promoted by IDEO since several years.

Although Design Thinking has been existing in design science since the late 1960s [SIM1969], [MCK1973], and became more and more a subject of higher education and literature [FAS1993], [FAS1994], [ROW1987], [BUC1992], it was David M. Kelley, the founder of IDEO, who adapted Design Thinking for business purposes [KEL2004]. Later on, especially Tim Brown has written and spoken extensively about IDEO's design philosophy and its potential relevance for other companies. He described how designers bring their methods into business, either by taking part themselves in business process, or by training business people to use design methods [KEL2005].

Generally speaking, Design Thinking describes the study of cognitive processes, which express themselves in design action [CRO2011]. Tim Brown

broadens this understanding and explains Design Thinking as "a methodology that imbues the full spectrum of innovation activities with a human-centred design ethos" [BRO2008]. He likes to express that innovation is powered by a deep understanding of the consumer needs and the role of the product to fulfil the users' requirements.

This is especially forced through direct observation. In his eyes, Design Thinking "is a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity" [BRO2008]. Thus, Design Thinking shares a common set of values that drive innovation:

- Creativity,
- Ambidextrous Thinking,
- Teamwork,
- End-User Focus,
- Curiosity.

The Design Thinking Process by IDEO is characterised by an iterative running through the following main phases:

1. Inspiration: This part labels the circumstances that lead to the motivation of searching for solutions.
2. Ideation: This section describes "the process of generating, developing and testing ideas that may lead to solutions" [BRO2008].
3. Implementation: During this phase the introduction on the market stands in the centre.

All these phases have several sub-cycles, which make designers deeper concerned with the future product [BRO2008].

To sum up, Design Thinking can be applied not only to the aesthetic aspects of products, but rather to all system aspects. At the core of the method are systems thinking, life-cycle thinking and working in creative interdisciplinary teams.

3.1.3 Importance of the Early Phase of Innovation

Koen et al. see the whole innovation process divided into three parts: the fuzzy font-end, the new product development (NPD) process, and the commercialisation phase. The fuzzy front-end is the sum of all activities which come before the well-structured NPD. In this context, Koen et al. point out that

many companies utilise a formal stage-gate process [COO2011] for managing product development for incremental innovations [KOE2002].

Regarding the entire innovation process, the first determinable stage is ideation [BUL2008]. Taking into account the previous explanations of the term ideation and relating it with the systematisation of the innovation process by Koen et al. [KOE2001], allows situating ideation more accurately. Figure 3-1 visualises the position of ideation in the innovation process.

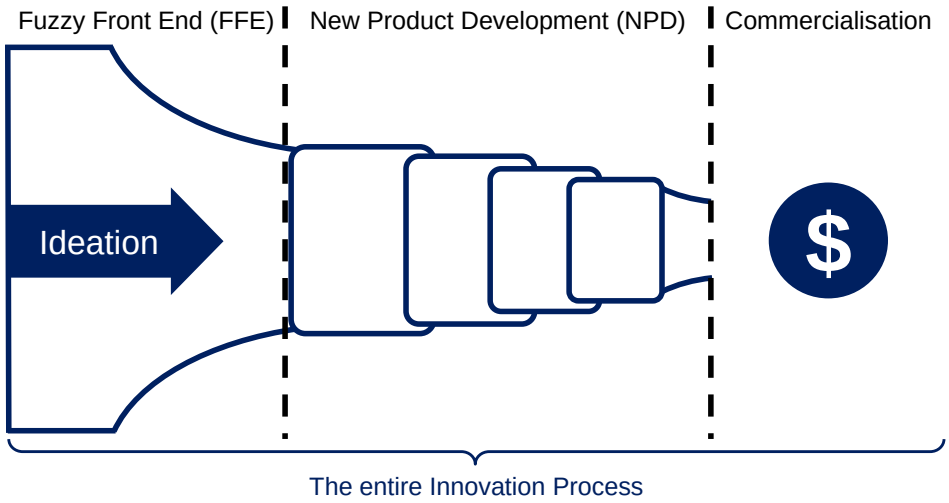

Figure 3-1: The Entire Innovation Process divided in Fuzzy Front-End, NPD and Commercialisation [KOE2002]

According to this location of ideation in the entire innovation process, the term "fuzzy front-end" is essential because it explains the earliest stages of new product development, even before its first official discussions [BRE2007], and ideation is at the very beginning of this front-end.

This early stage of the innovation process includes all the time spent on the idea as well as the activities enforcing it; from the first impulse and/or opportunity for a new product or a new service up to go/no go decisions concerning implementation and the start of development of the new product and/or service [REI2004], [HER2007b].

The effective management of the early phase of the innovation process is the origin for innovative ideas for sustainable competitive advantage [KIM2002]. This influence of the front-end on new product development has been verified by empirical studies [HER2007b], [VER2006], [VER2008], [STO2008]. Table 3-1 summarises the main results of these studies.

Object of investigation	Results	Source
144 German measurement and control firms	Companies which reduce systematically market and technological uncertainties during the fuzzy front-end of innovation belong to the more successful innovators	[VER2006]
497 New Product Development (NPD) projects from Japanese mechanical and electrical engineering firms	Key driver of project success is the intensity of planning prior to the start of development: relationship between front-end factors and project success	[VER2008]
475 Research and Development projects in Japanese electrical and mechanical engineering companies	Planning intensity during the early phase of innovation is linked to the project success	[STO2008]
Conclusions from the studies: high importance of • early reduction of technical and market uncertainty • early involvement of all relevant project members • early interdisciplinary teamwork and communication • early involvement of top management and allocation of resources		

Table 3-1: Studies confirming the Impact of the Front-End on NPD [HEL2009]

This thesis seeks to highlight the fact that ideation is a crucial part of the early phase of innovation, and that it is important for the future commercial success to structure the fuzzy front-end of innovation processes. This fact has turned out to be an effective measure in many of today's innovation leading companies. Therefore the next section will focus in greater detail on this crucial part of innovation.

3.2 Structuring Ideation

3.2.1 Ideation as Part of the Early Phase of Innovation

Innovation management in research and practice has largely focussed on finding the ideal innovation process [BRÖ2005], [COO2011]. In literature the innovation process is divided in an early phase considered as the front-end of innovation and a later phase called downstream [GLO2011]. The cutting point between these two phases is generally the first official discussion, where the top management decides upon the funding, staffing and the launch or kill of the project [KHU1997], [KOE2001]. This decision is also called "money gate" [HER2007b].

Smith and Reinertsen introduced the term “fuzzy front-end” in 1991 [SMI1991] to explain the earliest stages of new product development [KHU1997]. This early stage of the innovation process includes all the time spent on the idea as well as the activities enforcing it or not; so the fuzzy front-end covers the steps from idea generation to either its approval for development or its termination [ZHA2001]. The fuzzy front-end is challenged to combine on the one hand sufficient room for creativity and freedom of ideation and on the other hand systemised activities to enhance efficiency [HER2007b].

The main characteristics of the fuzzy front-end of innovation [GLO2011] – and these are the reasons why the expression “fuzzy” comes into play – are the following three aspects.

1. Uncertainty: Based in its nature, a new idea is associated with a relatively high degree of environmental uncertainty concerning e.g. customer/market demand, technology, suppliers, competition, internal organisation, resources, standards and regulations [GLO2011], [ZHA2001]. This uncertainty grows with increasing novelty [TRU1996]. Uncertainty occurs in consequence of missing and/or insufficient knowledge about the novelty of the project and the lack of experience with the necessary activities to reach the targeted result [TRU1996] and [THO1980]. Also, different kinds of risk accompany this uncertainty [TRU1996].

2. Ambiguity: The diversity in interpretation of any stimulus also contributes to this fuzziness [GLO2011]. The multitude of participants, decisions and interdependences connected with the front-end process generate also a high complexity of tasks, which can only be managed to a certain extent by the use of conventional routine jobs and decision mechanisms [STO2001]. This process of change that runs during the creation of innovations causes, however, also material-intellectual, socio-emotional and value-cultural conflicts [STO2001]. In this context, occurring questions are answered more by the exchange of personal opinions as on the basis of hard data [ZHA2001].

3. Dependency on individual performances: So-called “Product Champions” play a crucial role in the development of a raw idea into a concrete innovation [GLO2011], [KIM2002]. This “Champion” interacts with a large number of internal and external contact persons but in the end this single key person drives the fuzzy front-end activities pro-actively [STE2003].

Table 3-2 summarises the differences between the fuzzy front-end and the downstream innovation processes.

	Upfront	Downstream
Initial Situation	• Stimulus	• Product definition • Requirements specification • Business plan • Project schedule
Character of ideas	• Fuzzy, diffuse • Changeable, modifiable	• Clear, distinct, explicit • Specific • Detailed
Content focus	• Diversified • Vague	• Specified • Detailed
Understanding of customer relations	• Often not clear and not verified • Because of the degree of novelty the customer acceptance is possibly unknown	• By the use of interactions tested and increasingly more clearly
Market expertise	• Estimation of market potential, market size and market development is often rough	• By the use of market research concrete market situation is known • Forecast is more reliable
Understanding of technology	• Technical feasibility is hardly assessable	• Technical feasibility through development
Management commitment	• Low	• High
Degree of formalisation	• Unstructured • Experimental • Dynamic	• Structured • Planned • Goal-oriented
Degree of documentation	• Low	• High • Detailed
Employee	• Single person • Small team	• Multi-disciplinary development team
Forecast (e.g. sales)	• Speculative • Uncertain	• Increasingly analysable and predictable
Funding	• No official budget (bootlegging) or small global budget	• Authorised high-volume budget
Completion date	• Not predictable	• Determined date of market launch
Result	• Blue print • Product concept	• Market-ready product
Basis of decision-making	• Qualitative data • Estimations	• Precise, quantitative data
Termination decision	• Easy • No or small costs	• Difficult • (Partly high) sunk costs

Table 3-2: Comparison between Front-End and Downstream of the Innovation Process [GLO2011], [HER2007b], [KOE2001]

Despite its fuzzy nature, an increasing number of studies highlight the importance of the front-end of research and development (R&D) projects for the overall success of innovations [BRÖ2005], [COO2011], [KIM2002], [STE2003]. The reason is that decisions made in the very early phase largely determine not only the resulting innovation, but also the whole innovation process with its related costs, time frame and the resources needed [BRÖ2004] and [MIC2006a]. The fuzzy front-end with its sub-phases of idea generation, evaluation and selection affects the quality of the generated ideas. The effectiveness of the evaluation and selection methods applied during the whole innovation process has a significant impact on the downstream process phases, especially the development and commercialisation [MUR1997].

Because of their highly creative and dynamic character, it is practically impossible to describe the fuzzy front-end activities in the form of one generic front-end process. Senhar points out that the "one size fits all" paradigm assumed in project management literature does not take effect [SHE2001]. Consequentially, differences in the structural and environmental factors of R&D projects and the increasing importance of this diversity have to take into account by R&D management research as well as R&D practice [SHE2001] and [BUT2004]. The very complex and risky character of the fuzzy front-end makes the implementation of a process which actively influences the ideation into existing processes very complicated in practice.

From the large variety of models which are discussed in literature, the ones presented in the following section contribute to widely recognised explanations for structuring the fuzzy front-end. Also these models help to build up a common understanding of the innovation process with its different perspectives, and support us in the creation of an ideation process.

3.2.2 The Holistic Front-End Model

One of the most significant—and for this research work most inspiring—process models for the fuzzy front-end of NPD is Khurana and Rosenthal's holistic front-end model [KHU1997]. Their model of the new product development front-end is divided in three phases and ends with a top management decision about the continuation of the project. Based on their studies, Khurana and Rosenthal highlight the fact that the individual but interrelated activities are often handled separately. So they suggest a process model where the overall product and portfolio strategy is a foundation element and the "understanding of the interrelationships between the activities is as important as the activities themselves" [KHU1997].

In the first phase, the so-called "Pre-Phase Zero", the company starts with activities concerning idea generation, market analysis and technology evaluation to discover a product and/or market opportunity. This Pre-Phase Zero corresponds to our definition of the ideation. "These Pre-Phase Zero activities are the least explicit and most fuzzy, and a deeper understanding of these decisions is needed through further research" [KHU1998].

If an opportunity appears to be worth a further exploration, the next phase, named "Phase Zero", will be initiated. In this phase the company assigns a project group, where suppliers can be part of as well, to consider different perspectives and to complete the picture. The mission of this group is to develop a product concept and specification together.

The third phase, "Phase One", includes a feasibility study to confirm the product concept, as well as the concrete project planning.

The main tasks of these stages of the front-end process are to identify customer needs, the target market segments, and the competitive situation. Also, the business and the technical feasibility of the new product have to be assessed, including the necessary resources and competencies. The validation of the product concept, as well as the exact project planning including time schedule, personnel and resource planning have to be done. The end of the front-end process marks the presentation of the business case by the project team. Finally, the go or no-go decision by the top management about the project closes the process [KHU1997]. Figure 3-2 shows Khurana and Rosenthal's model of the front-end of innovation, where we highlighted our research focus of the still less explored ideation part:

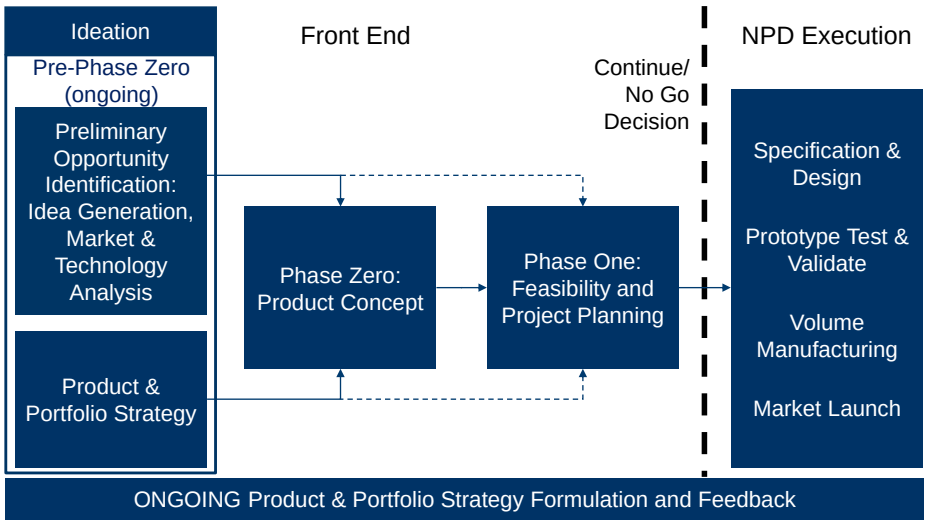

Figure 3-2: Front-End Model by Khurana and Rosenthal [KHU1998]

For Khurana and Rosenthal's process description, the conceptual integration of fundamentals from the organisational environment—the so-called foundation elements—is extremely important. These foundation elements are key drivers of the model, just like the portfolio and product strategy, the organisation structure in the form of cross-functional project organisation, clear roles, communication structures and leadership. During the pre-phase zero, they influence e.g. the qualitative screening, which has to be aligned with existing products and the overall product strategy. In the later phases, these foundation elements have an impact on the quality and the efficiency of the execution, as well on the informal selection of alternatives.

In Khurana and Rosenthal's front-end model, four key roles play a major role: the core team, the project leader, the executive review committee, and the senior management [KHU1998]. The cross-functional core team accounts for the activities in the Phases Zero and One. The formal or informal project leader is in charge of support, communication and motivation. The executive committee is responsible for the evaluation of the project at the checkpoints of the product development process, especially at the continue/no-go decision point. Senior management provides the organisational fundamentals, like the product strategy, portfolio and project resource plans.

The consideration of the organisational context of the company for the successful integration of the front-end process in existing systems makes this model so important. Through their studies, Khurana and Rosenthal investigated the fact that there is no universal system for structuring the fuzzy front-end. They explicitly indicate that company size, decision-making style, operation culture and frequency of new product introduction are critical factors for the implementation of a front-end process model. To resolve the fuzziness, they recommend a balanced connection of operational and strategic activities by crossing functional boundaries [KHU1997].

3.2.3 New Concept Development Model

Another fuzzy front-end model with large impact is the New Concept Development (NCD) model. Based on their industrial research and in comparison with the concept shown in the previous chapter, Koen and his colleagues try to explain the fuzzy front-end with the objective to design a model that represents the character of this phase rather than developing a reference process. As a continuous progress of the holistic perspective from Khurana and Rosenthal, the NCD model includes in addition to development activities also internal and external factors. This theoretical construct provides a common language and definition of the key components of the front-end of innovation [KOE2001] and [KOE2002].

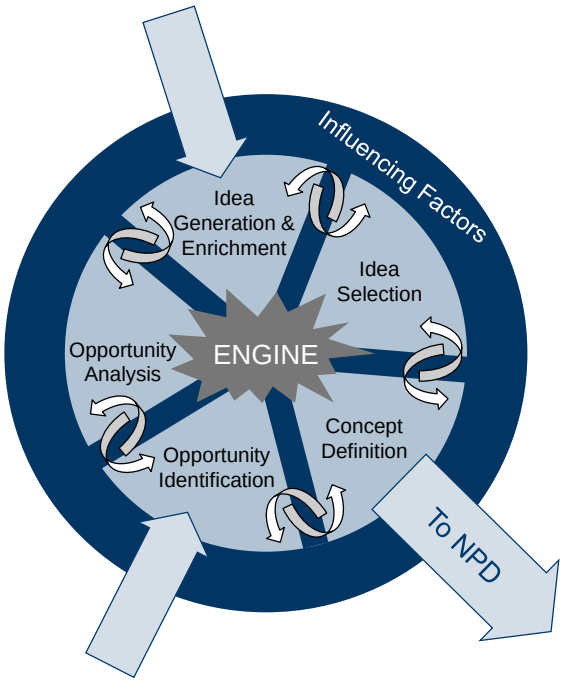

Figure 3-3: The New Concept Development Model [KOE2002]

Figure 3-3 shows the NCD model, which comprises three major parts [KOE2001] and [KOE2002]:

1. The *influencing factors* bundle the peripheral environment of the process. These factors are on the one hand internal factors such as the organisational capabilities, business strategy, enabling science and technologies, and on the other hand also external factors like the outside world (government policy, environmental regulations, laws concerning patents and socioeconomic trends), distribution channels, customers and competitors. The influencing factors are sources of new ideas and affect the entire innovation process, including the fuzzy front-end as well as the NPD and commercialisation.
2. The core of the model is the *engine*. It includes the leadership and corporate culture and drives the five front-end elements.
3. The *five controllable front-end elements* consist of the following activities (no sequential order):
   (a) Opportunity Identification concerns the identification of product or market opportunities, which the company wants to pursue and which are driven by the company's objectives.

(b) Additional information is collected during the Opportunity Analysis to assess the value of the opportunity. So it is possible to translate the identified opportunity into specific business and technology opportunities. The extent of the effort for the analysis depends on the information needed to reduce uncertainties. Typical questions are: How attractive is the opportunity? What size has the future development effort? Does the opportunity fit with the corporate strategy and culture? How high is the decision makers' risk tolerance?

(c) The element of Idea Generation and Enrichment represents the birth, development and maturation of an idea. Through the integration of customers or users and other external stakeholders, like collaborations with other companies and institutions, the opportunity is evolutionarily modified to a concrete idea. Also cross-functional teams enhance the idea generation. This element of Idea Genesis can also be encouraged from the outside, for example through new materials available on the market or random test result in the laboratory. The result of this part of the NCD is usually a detailed idea description or a product concept.

(d) The output of the idea generation is the subject of the next element, called Idea Selection. Here a first evaluation of the idea happens. As the level of information at this stage has a still great deficit, and financial details are usually very roughly estimated, Koen et al. show the need for a multidimensional evaluation approach. Possible assessment criteria are investments, risks, competition, existing competences and the product benefit.

(e) The last element of the NCD model is the Concept Definition. The selected ideas have to be concretised by the development of a business case, which includes estimates for investment in the business or technology. The formality of the business case depends on several factors, like the nature of the opportunity, level of resources, the organisational requirements to proceed to the NPD and the corporate culture. With the development of the business plan and/or a formal project proposal the final deliverable has been completed, and the idea can be transferred from the NCD to the NPD process.

Although several characteristics of the model have great similarities to the previous concept from Khurana and Rosenthal, this model differs in three major aspects. First, the inner parts of the NCD were designed as elements rather than processes. This contains the explicit reference to the iterative nature of the described activities, also graphically represented through the circular shape. Ideas are expected to flow and circulate between and among all of the five front-end elements. Furthermore, the NCD takes into account the influence of the internal and external environment to specific activities. Finally, the

intensity of the activities relies on the content of the opportunities, like the degree of innovation, and on the corporate culture [GLO2011].

3.2.4 Probe and Learn Process

This process highlights the aspect of learning-based strategies concerning the front-end of innovations. Based on the examination of four successful radical innovations, Lynn et al. derive the Probe and Learn Process to fulfil the specific requirements of high technical risk and/or market uncertainty [LYN1996]. The Probe and Learn Process is particularly designed to reduce uncertainty during the early phases of innovation and corresponds to the iterative procedure and learning-based strategy that Verworn and Herstatt recommend for radical innovations [VER2007b].

For radical innovations, neither the design nor the potential customers are known at the time of market launch. Therefore Lynn et al. propose an iterative procedure: Early versions of products will be introduced to test markets, modified due to the learning experiences and re-tested in the market. These iterations will be repeated as long as all necessary information has been generated. At the from Lynn et al. studied product developments, the iterative learning processes took partly several decades before a successful product could be introduced on the market [LYN1996].

The first step (“probe”) has the character of an experiment. A first product version will be introduced to a plausible initial market. For example, General Electric tested a breast scanner to enter the Computer Axial Tomography (CT) business in the mid-1970s. Lessons learned from this test were used to develop a whole-body scanner. At this, the experiments should be targeted to obtain the required information. The innovation process for developing a whole-body scanner is shown in Figure 3-4 [LYN1996].

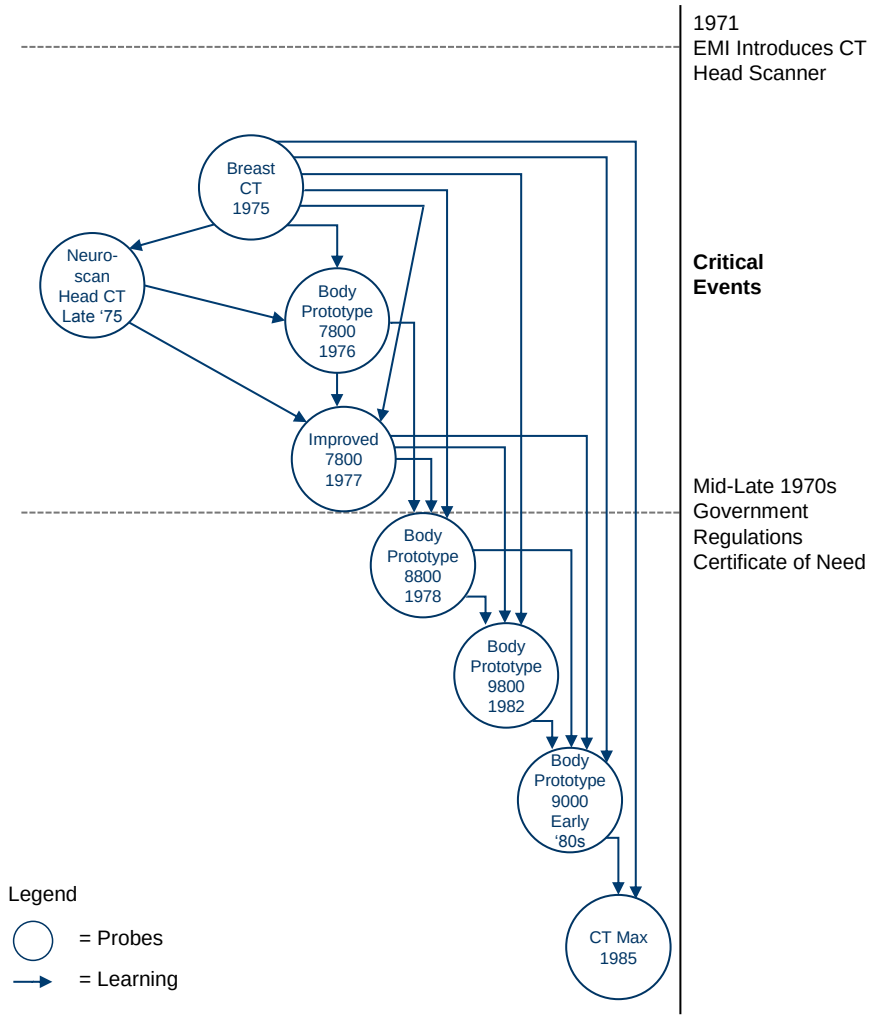

Figure 3-4: Example of GE's Probe and Learn Process [LYN1996]

The iterative Probe and Learn Process is the opposite of conventional sequential stage-gate processes. The emphasis is on learning-based creation of new knowledge and not on process efficiency. None of the products which Lynn et al. described, would have passed one of the gates of a sequential process during the early phases of innovation. Accordingly, the application is not in the field of incremental innovations, but in the area of high uncertainty, which can only be reduced through learning. This includes not only radical innovations but also technical innovations and market innovations. For technical innovations product tests should have their focus on learning experiences and for market innovations the test should prioritise feedback from the market [VER2007b].

3.2.5 The Stage-Gate Process

One of the most popular models in industry and widespread among professionals [COO1990], [COO1991], [RUN2002], [WHI1998] is the stage-gate process by Cooper [COO2011]. It is implemented in companies such as 3M, Procter & Gamble or Hewlett Packard [VER2007b], to name only a few.

The innovation process is divided in individual, sequentially proceeding phases called "stages". The various stages are multifunctional. After each phase, there is the decision about the continuation or termination of the project. This "gate" decides about the go or no-go. It also will be checked whether the respective phase was conducted properly and necessary deliverables have been accomplished. Also, the conditions will be reviewed that a project is ready for the next phase of the innovation process [VER2007b].

Figure 3-5 shows a stage-gate model for the early phase of innovation. First, ideas will be generated by the use of internal or external sources. During a first screening, there is the decision about the allocation of first small resources to develop the idea with the view to the market and the technology to integrate both perspectives. These activities happen in parallel. On the basis of these engrossed information, it will be decided whether the idea will be developed into a concept at a second gate. If this decision is positive, then the collected information will result in a product concept. After the development of a technical concept to implement the idea, the acceptance on the market will be tested through market studies. Depending of the results of concept tests, the decision about the implementation of the concept and further allocation of resources will be made. A cross-functional team is involved in all the individual gate decisions [VER2007b].

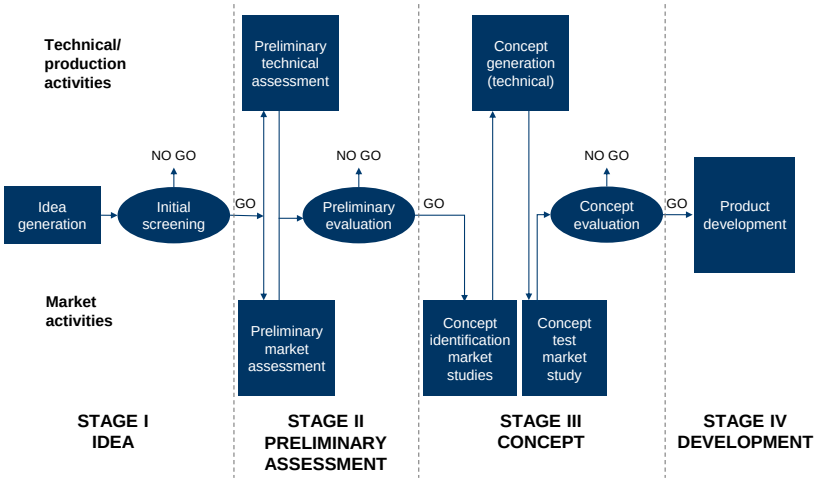

Figure 3-5: Stage-Gate Process of the Early Phase [COO1988]

The main advantages of a stage-gate process lie in the fact that a common understanding about the steps of the innovation process can be achieved. It provides clear objectives against which projects can be assessed at each gate. After each phase, a review of the implementation takes place. Thus, a previously ad-hoc approach of development is systematised to increase the efficiency and effectiveness of each stage [VER2007b].

On the other side, the main criticism of the stage-gate process lies in its sequential design and its lack of flexibility. Also, the first stage-gate models described by Cooper paid less attention to the early stages, in particular the idea phase.

In order to integrate also non-directional fundamental research, Cooper and colleagues introduced an additional process chain, the "discovery stage" for technical developments which should take into account the experimental nature of technology-induced innovations. However, this approach also failed in the detailed description of the ideation, because the phases are very roughly defined. The activities are much diversified and again there is no concrete explanation for the generation of ideas.

Actually it seems to be a fact that the question how to manage ideation is still unsolved in industry. Further research work has to close this gap.

3.3 Managing Ideation

3.3.1 Creativity Freedom versus Structural Organisation

Due to its characteristics and its exposed position in the entire new product development process, the fuzzy front-end is challenged to shift between the conflicting priorities of structural organisation and creative freedom. Up to now, there is no simple recommendation to solve this dilemma through innovation management. Although science tries to find possible ways, business practice does not follow. In fact, there are many conflicts, contradictions and paradoxes. Gassmann and Sutter entitle this situation as "Innovation Paradox" [GAS2011]. As an example they describe the case that innovations requires both creativity and discipline in the team to assure the successful launch of market-oriented products and services.

Nevertheless professionals are still confronted with the question, how the fuzzy front-end can be structured to channel development-related and decision-relevant information to select systematically those product ideas which seems to be the most profitable on the market. But to find a proper way of solving this

problem, they have to answer the following questions: How much structure is the creativity of employees able to bear? How can the flow of ideas be managed, without "nipping creativity in the bud"? Figure 3-6 illustrates this dilemma between creativity and structure [SAN2007].

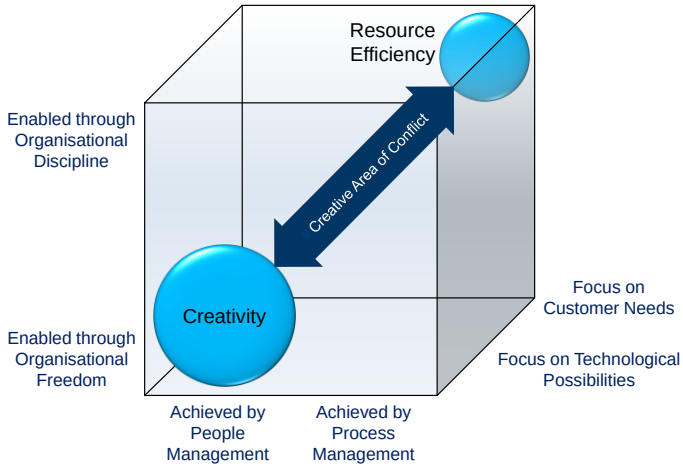

Figure 3-6: Dilemma between Creativity and Resource Efficiency in the Fuzzy Front-End [SAN2007]

Freedom and intense people management encourage creativity. In contrast, the efficiency of the invested funds can be only achieved by discipline and high emphasis on process management. Overall, the requirements of the market and the customer needs dominate the creative technical ideas of the developer [SAN2007].

The effective management of the early phase of innovation has to generate an efficient process that gives sufficient freedom for creative development of the employees. Also, this process needs to be flexible enough to react to changing market demands, which occurs through new customer needs or new technological possibilities [SAN2007].

Therefore, a company has to manage the ideation environment in a balanced mix of overall flexibility and guided focus [NAM2002]. The resulting area of conflict between creativity and resource efficiency provides the breeding ground for developing new product ideas [SAN2007].

Verworn and Herrstatt highlight the fact that the degree of uncertainty is on its highest level in the front-end of innovation processes, and so flexibility has the highest priority. They suggest that the management of the fuzzy front-end has to be adapted to the level of uncertainty for the different types of innovations (already shown in Chapter 2.2.1). Innovation strategies and processes models have to reflect the respective market and technology uncertainties [VER2007b].

The matrix in Figure 3-7 pictures the four types of innovation, each representing a different degree of market and technology uncertainty [VER2007b].

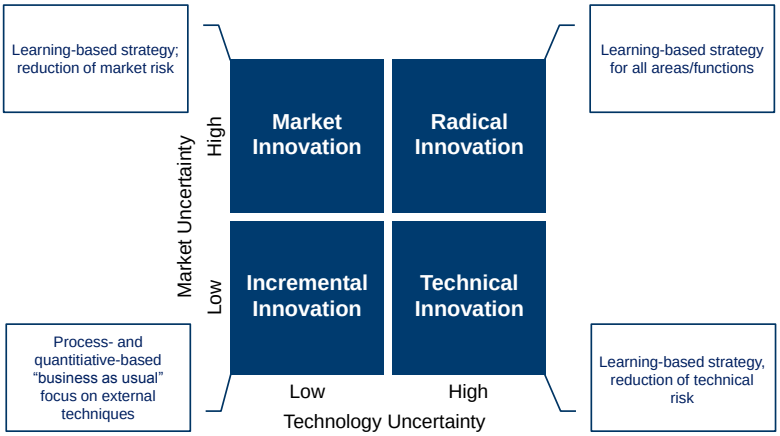

Figure 3-7: Uncertainty Matrix, related Innovation Strategies and Process Models [VER2007b], [LYN1998b]

Based on this uncertainty matrix it is possible describe the relationship between the type of innovation and the needed degree of formalisation. For incremental innovations with low market and technological uncertainty, structured and process-oriented activities can make a contribution to an efficient implementation. As technologies and market conditions are largely known, the planning can be done with a high degree of accuracy and consistency. Also predictions will be performed with high reliability by using external forecasting techniques like customer surveys [LYN1998b].

If the market uncertainty is low and the technological uncertainty is high, or vice versa, the focus should be on building up activities on the existing knowledge and reducing the residual risk. Splitting the ideation process in strictly sequential phases will not meet the requirements of reducing technical or market uncertainty, and minimising the technological uncertainty. Here a learning-based strategy and an iterative procedure are recommended [VER2007b].

The most extreme case of innovation represents the radical innovation that seeks for new markets with new technologies. For these innovations, all areas and functions have to go gradually through extensive processes of learning and experience. For this purpose, the process must have the necessary openness to guarantee iterations and to make the integration of feedback possible at the right time [VER2007b].

3.3.2 Idea Sources Inside and Outside the Company

The success of the whole product development process heavily depends on the input to the ideation system that collects, examines, evaluates and selects new concepts and ideas. Stevens and Burley [STE1997] have shown in their study that it takes 3.000 raw ideas to identify approximately 300 novel ideas out of which only nine are commercially significant. Finally only one single idea achieves a significant business success. This poor success rate proves that "It seems we need ideas, and we need lots of them" [DAN2008a]. Thus ideation processes have great importance. The main purpose of all idea generation activities is to ensure that the company does not leave the exploration phase of new product development to chance [STA1992].

Companies have to be aware that idea generation does not happen

- informally and without specific purpose [ADA2005],
- sporadically [TUC2002], and neither
- as a merely in-house method [CHE2003].

In fact, all members of the innovation value chain should participate in a systematically and continuously organised ideation process to guarantee sustainable innovation results and business success [NEU2011b]. For example, several researchers state that ideas developed from a deep understanding of the customer usually have higher value and better chances of succeeding [FLI2002].

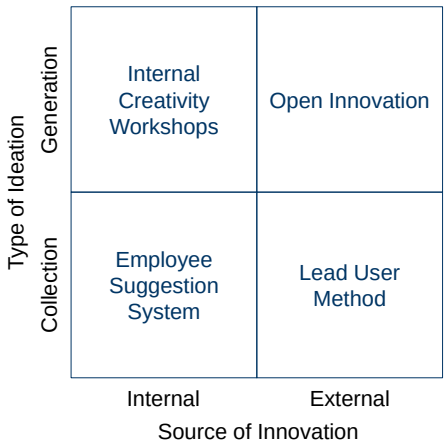

Figure 3-8: Ideation Matrix: Internal and External Idea Collection and Generation [BUL2008]

Therefore the major task of ideation is to identify, find and use adequate idea sources inside and outside the company. Ideation happens right at the beginning, and it is important to collect and generate ideas by using internal and external idea sources. Figure 3-8 summarises this consideration by using four well-known examples [BUL2008].

In her book "Innovation and Ontologies – Structuring the Early Stages of Innovation Management" [BUL2008], Bullinger deals extensively with the question of potential sources of ideas. She lists possible external as well as internal sources of ideas based on various publications, and consequently offers a good starting point for further exploration of idea sources. Table 3-3 shows Bullinger's summary.

Internal Sources of Ideas	Research	• Joint projects • Literature (books, academic and management journals) • Lectures (fairs, universities)
	Analysis of Environment	• Trend reports • Research on patents, market and technologies • Competition (benchmarking, catalogues)
	Human Contact	• Shareholders • Customers (retailers, consumers) • Partners (suppliers, knowledge brokers, investors, consultants, shareholders, etc.) • Universities • Competitors
External Sources of Ideas	Internal Analysis	• Controlling (sales figures, cost of R&D, etc.) • Complaints of consumers • Quality reports • Information of sales representatives • Staff surveys
	Communication	• Conferences • Team talks • Innovative culture and social activities
	Spontaneous Ideas	• Product and/or process suggestion • Idea for improvement
	(Systematic) Idea Generation	• Workshops • Quality circles • Training programs • Communities of practice • Continuous improvement

Table 3-3: Possible Sources of Ideas [BUL2008]

Futhermore, Bullinger introduces the ideation process by Herstatt und Lüthje [HER2005], which represent a systematic approach for idea gathering and idea

generation, and combines this process with methods of ideation. The major steps of this ideation process are:

- *Initiative to innovate:* The motivation for ideation can be related to explicit occasion or can be designed as a continuous task.
- *Information gathering:* On the one hand related to purpose which includes ideas that fulfil unsatisfied needs and requirements to serve new target groups, and on the other hand related to means which are technology-driven ideas that aim new principles, product architectures or materials.
- *Idea generation:* New ideas occur through the combination of purpose and means.

Figure 3-9 shows Bullinger's approach.

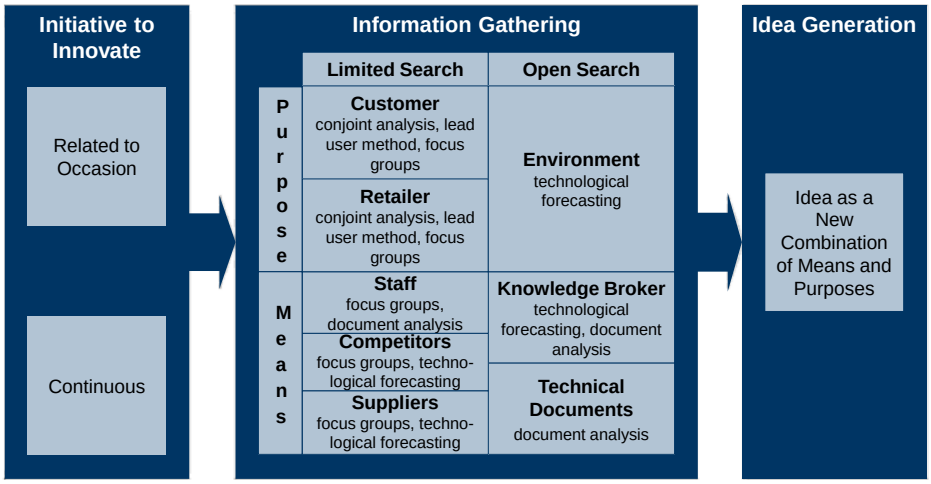

Figure 3-9: Process of Ideation Inclusive Methods [BUL2008]

These considerations of stakeholder integration focused on ideation confirm the assumption already made in Chapter 2.4 and 2.5. To guarantee long-term success of the management of ideation, the systematic integration of all stakeholders is a must. And to make this cooperation work, the information exchange between the several partners has to be assured. In this context, knowledge and learning are the main levers of ideation.

3.3.3 Knowledge and Learning

Ideation occurs through interactions inside or outside an industrial firm and the sources can be individuals or groups [ALA2003]. Due to these comprehensive

and profound interactions within the corporate divisions and/or the business environment the innovation management as the responsible managing link between ideation and the whole innovation process represents a company-wide function with influence on the leadership of the whole corporation [DIL1994], [PLE1996].

In their review of several studies on the success and failure of new product development, Martínez-Sánchez et al. identified that the use of multifunctional teams and the adoption of inter-department responsibilities are positively related to the new product performance, including development and marketing time [MAR2006]. Therefore the central purpose of the innovation management is to ensure information flow (e.g. by organisational measures), and to initiate and continuously guarantee information and knowledge exchange [STO2001].

Many authors articulate the vital role that knowledge and learning play in innovation activities, underlining the importance of processes and mechanisms for collecting information and creating knowledge from both internal and external sources [AYU2006]. In operational effectiveness, the main aspect involves organisational learning activities that bring understanding of action outcomes, causal connections and result in higher-order learning [ARG1996]. It is also important to consider aspects in the knowledge creation process: the organisation's internal knowledge base, the acquisition of information and knowledge from external sources, the integration of internal and external knowledge and its application to problem solving, the creation of new knowledge and the generation of innovations from this integration, and finally the importance of the organisation's capacity to absorb new knowledge [SOO2002]. This process of knowledge creation is depicted in Figure 3-10, according to Soo et al. [DEV2010].

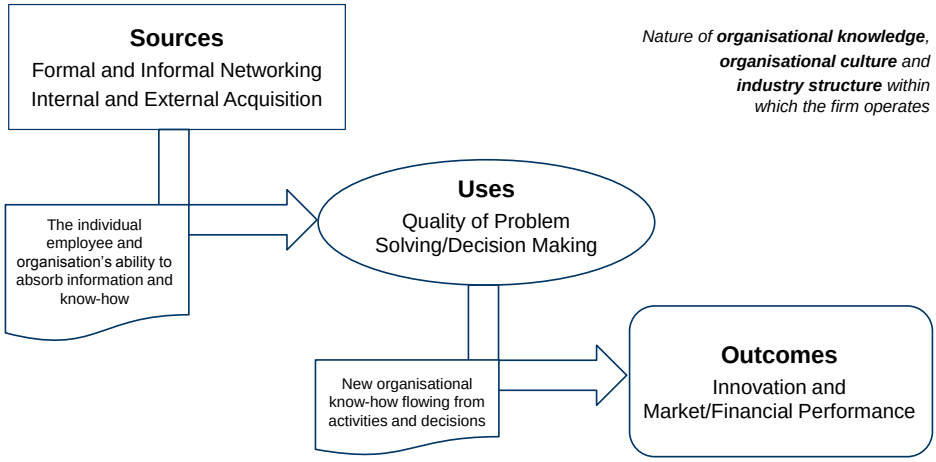

Figure 3-10: The Process of Knowledge Creation and Innovation [DEV2010]

Scanning the environment, networks and alliances for alternatives and observing competitors also leads to potential alternative practices and ideas. Most firms are engaged in these activities simultaneously because they manage several concurrent projects at different stages in the product development process [ROT2004].

To capture new ideas from different sources, it is essential to identify potential sources inside and outside the organisation. Specific methods to access, to extract and to use their knowledge and their ideas have to be found.

3.4 Implications from this Chapter

Ideation—the procedure of idea generation and selection—happens in the so-called "fuzzy front-end" of the otherwise well-structured process landscape of numerous modern organisations. This makes it difficult to structure and manage ideation in a way that the organisation can capitalise on creativity of internal and external idea sources to a maximum.

Up to now, several models—mainly in the field of NPD research—exist that try to solve this dilemma by finding a structure embedded in a defined process to explain the fuzzy front-end. The most obvious characteristic of these models is that they assume the existence of an idea without explaining how this idea was born. Here is a clear gap in research, which we want to bridge with this thesis by dealing with the overall question about how ideation should be structured and managed to guarantee market success thanks to ideas leading to innovations.

Part II:

Creation of an Ideation Process

4 Conceptual Framework of the Research

4.1 Point of Departure

The literature review so far (primarily Chapter 2 and 3) has shown that numerous publications in the field of innovation management as well as FFE and NPD research discuss the use of different methods and instruments

- for the establishment of an adequate business environment,
- for the accomplishment of planning and managing complex and interdependent sub processes,
- to increase efficiency and
- to control and decrease risks

in connection with innovation processes and new product development from an abstract-theoretical perspective [STO2001].

From an entrepreneurial point of view, the methods and instruments presented in the literature can only be used in limited ways due to the missing consideration of company-specific characteristics [HAM1989]. In this context Cooper and Kleinschmidt stated: "…what the literature prescribes and what most firms do are miles apart when it comes to the new product process" [COO1986].

In view of the all-encompassing definition of innovation management—as presented in Chapter 2.3—this discrepancy between theory and practice is understandable. Also, the study by Oliver Wyman Automotive [DAN2007] illustrated in Chapter 6.2.2 verifies that different and deviating innovation management strategies exist especially in the automotive supplier industry. These different systems are legitimate because of the novelty and the variety of innovations. Thus innovation management is forced to be defined and adjusted consistently anew.

Now, the inevitable question arises to which extent the innovation management can be realised in practice within the sector of automotive supplier industry. However, the organisation of innovation management is exceedingly difficult if the product development systems are already well-established within the company. Therefore the innovation management has to concentrate on its central function which has its origin in the process character of innovation and is contained in most definitions of innovation management and makes innovation management so unique in relation to other management tasks: structuring and managing the early beginning of innovations within the fuzzy front-end.

4.2 Research Question

The assumption of our research work is that companies have to find ways to organise the earliest phases of their innovation management with a strong focus on leveraging ideation within and across their entire organisational structures. Taking into account the main issues outlined in Chapter 4.1, we can formulate our central research question as follows:

> ***How is it possible to create a structured approach, which explains ideation as the core task of the FFE, and to implement this process in a company's environment such that it successfully facilitates innovation management in practice?***

This general research question requires first of all a basic understanding of the particularities of ideation, which Chapter 3 of this thesis attempts to provide. Given these particularities, the question is how companies can deal with them to innovate more efficiently and effectively than they do today. A possible answer is the creation of an ideation process. This leads to the following sub-questions of the research question:

1. Where do new ideas come from?
2. Which internal and external sources are especially suitable for ideation in general?
3. What kind of organisational culture supports the generation of ideas?
4. Is it possible to measure the success of ideas, and if yes, how?
5. How do enterprises within and outside the automotive industry structure their ideation process?
6. Which best practice examples can be derived?

7. Which lessons learned have to be considered during the creation and implementation of an ideation process?
8. What kind of interfaces and responsibilities are needed for the generation and selection of ideas?
9. Which further processes, methods and systems are connected with an ideation process (decision-making process, communication paths, declined ideas, etc.)?

The challenge that has inspired this thesis is to concentrate on the process of ideation as the topic of this research work. Thus, the ideation process represents the core subject of our studies. In this context, indicators and assessment criteria that help measure the performance of the ideation process, are further fields of interest. They will help in several ways:

1. During the process, there are several decision points where assessment criteria play a critical role. So they have to be defined through the whole ideation process to support the responsible management with the review of the ideas and go/no-go decisions. Only if the idea fulfils the defined criteria, it will enter the next phase of the ideation process.
2. Another aspect why indicators and assessment criteria are also important for this research is the fact that the NPD process follows at the end of the ideation process. So finally it has to be estimated if one idea is a "good" (this attribute has to be defined) idea for the transfer to the further entire innovation process. For this final decision also go/no-go indicators have to be defined.
3. And in the end, there should be an evaluation of the research project. Here the major question that the indicators and assessment criteria has to answer is: Does the implementation of the proposed ideation process fulfil the targeted expectations?

Point 1 and 2 are highly interlinked with the creation of the ideation process and these decision criteria will be the subject in Chapter 5.6.2. Point 3 addresses the assessment and interpretation of the results of the case study in Chapter 6.5.8.

4.3 Research Objectives

The main focus of this thesis is to create an ideation process model suitable for the automotive supplier industry, which is characterised by a strong process-orientation, in particular in Western countries. As a practical case study, this

ideation process shall be implemented within the author's corporate environment in order to improve the existing innovation process there.

Against this background, the primary research objectives can be defined as follows:

- Creation of a generic ideation process model.
- Definition of indicators and assessment criteria to monitor ideas during the process and rate their commercial success.
- Derivation of a company-specific ideation process, and implementation in the context of the existing innovation process.
- Identification of company-specific indicators and assessment criteria and their interdependencies with the defined generic monitoring and rating criteria.

The documentation of the case study will explain the specific targets of the implementation project (see Chapter 6.4).

4.4 Research Approach

4.4.1 Selection of an Appropriate Research Design

Because this thesis has emerged from practical environment, a pragmatic worldview [CHE1992] dominates the research work. The major elements of this position are [CRE2009]:

- consequences of actions,
- problem-centred,
- pluralistic,
- real-world practice oriented.

This philosophical idea influences the practice of research and shapes the research design. In the centre of this research work stands the solution to a practical problem. *How* must an ideation process *that works* look like? This urgent need for action explains the pragmatism [CRE2009].

This general orientation made us choose a qualitative design for our research [CRE2009]. We like to explore and understand the drivers towards an ideation process applicable to the automotive supplier industry. Creswell describes the process of qualitative research as [CRE2009]:

- involving emerging questions and procedures,
- collection of data in the participant's setting,
- data analysis inductively building from particulars to general themes,
- researcher making interpretations of the meaning of the data,
- flexible structure of the final written report.

Basically the pragmatic worldview allows using mixed methods research, which combines at least one quantitative method and one qualitative method [GRE1989]. However, we prefer a multi-method research that includes exclusively qualitative methods [MOL2010]. For our research, the qualitative design seems to us the most promising and practicable approach based on the specific characteristics of our research topic like the dynamics and creativity that are intrinsic to ideation. In this case, qualitative research is always recommended when hitherto less explored areas of reality come into consideration [FLI2009].

In our research design we want to combine two qualitative strategies of inquiry: the grounded theory and the case study. The first approach, grounded theory, is a methodology that enables the researcher to develop a general, abstract theory of a process grounded in the views of participants [CRE2009]. The second strategy, the case study, allows the researcher to explore profoundly a process of real-life events, which are bounded by time and activity [YIN2009].

The findings from these two strategies are interlinked and close the gap between Part II and III of this thesis.

4.4.2 The Role of the Researcher

In principle, the development of the ideation process in this thesis will be conducted in a team composed of internal and external experts. This operative research team counts three members: the author, an external consultant, and the author's co-supervisor. The author's insider perspective offered detailed know-how about typical practices in the daily business at the investigated company. The outsider perspective allowed a critical distance to this processes and activities and an in-depth reflection based on experiences from the concerned business sector, the automotive industry, and also from other sectors.

This team composition is the result of the following considerations concerning added values:

- skills, experiences, and viewpoints of the team members are complementary;

- a clear focus on short-term and company-specific project goals with high strategic character has to be kept;
- responsibility for the quality of the results has to be taken;
- openness and flexibility are indispensable to succeed in the real industry setting.

To sum up, new knowledge about the existing situation of ideation and associated restrictions could be produced through this collaborative and interdisciplinary research work.

4.4.3 Methodology

The creation of the ideation process model seeks to link theoretical principles with industry experiences and happens in two sequential – but interlinked – steps:

1. Step: The description of a general ideation reference process model, which can be used as reference and applied to the specific case study, and is also adjustable to business sectors other than the automotive supplier industry.

2. Step: The description of the company-specific ideation model based on company-specific modifications of the general ideation process model.

A reference model arises from best practice examples or from theoretical assumptions and provides the basis for the configuration of optimal sequences [MEB2008]. In the further course, our research work addresses the identification and analysis of such best practice examples. Based on our research findings we are able to define a generic ideation reference process model in the sense that its general description can give guidance for the implementation of company-specific ideation processes.

A reference model provides, like traditional process models, a sequence of activities. It also refers to a concrete scope of applications, and describes concrete operations [MEB2008]. Furthermore, a reference model is designed for reuse, but it has to be consistently adjusted to the specific conditions. Therefore, it has only a recommending character [LAS2006]. This adaptation of the ideation process model is our second step, which can be achieved by identifying company-specific needs for action to ensure the practical implementation. This identification of priority areas of action for the case study is presented in Chapter 6.5.2.

Following this brief guideline of our research, we will put a focus on analysing best practice examples. We will derive from them key success factors representing the main causes for success. On the one hand, these key success

factors will be derived from innovation theory, and on the other hand from documented case studies of companies which are particularly successful in ideation. A literature review will cover the theory part, and expert interviews will provide new insights or approve aspects compared to the findings based on the secondary data. Based on these key success factors the reference process model will be created. This model provides the basis for the company-specific ideation process developed in the case study at KSPG. Figure 4-1 summarises this approach.

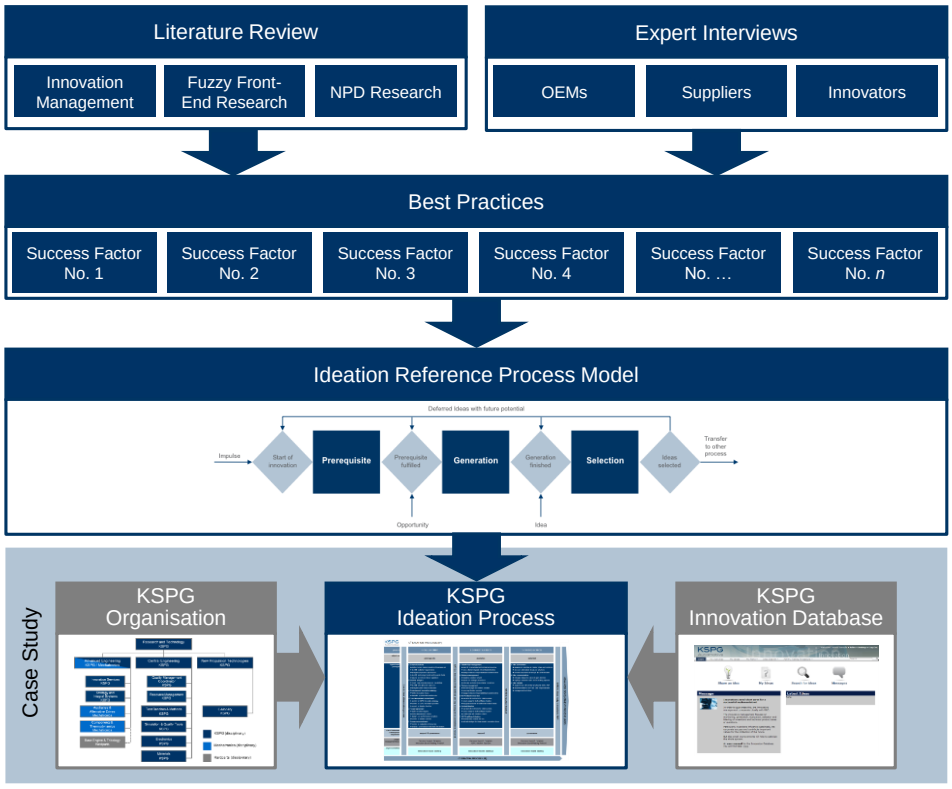

Figure 4-1: Conceptual Framework of the Research Approach

4.4.4 Multi-method Data Collection and Analysis

As pointed out before, the process of data gathering consists of literature review and expert interviews. The first part of the chosen multi-method research includes the analysis and evaluation of secondary data, like available publications and presentations. For the second research path the choice of the suitable method to capture the data fell on the qualitative, guided expert interview [WIT2000], because it is particularly used for the reconstruction of

complex knowledge and expertise [MEU1997]. The main goals of the expert interviews are: 1. the validation and the 2. complementing of the findings from the secondary data.

Both research methods, literature review and expert interview, will be analysed together and the findings will influence each other. With this combination of academic and industry sources we want to find a balance between recommended and best practice. Figure 4-2 shows how the research methods are interconnected during the data collection.

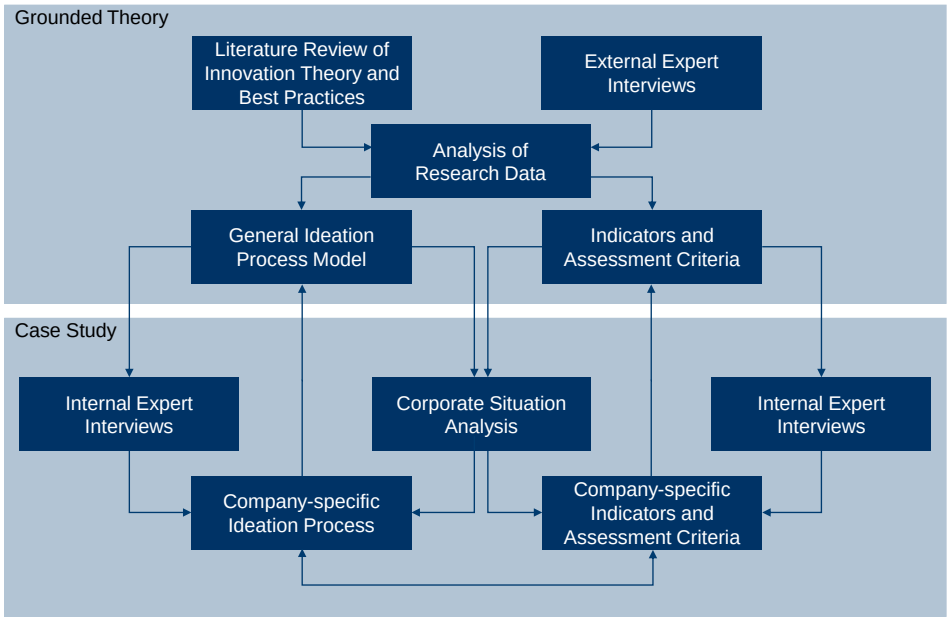

Figure 4-2: Interdependencies of the Data Gathering for the Research

Although we use two different research strategies, the grounded theory and the case study, the respective findings will be exchanged between these two parts of the research. With this procedure we want to achieve a considerable increase in quality of the proposed ideation process.

We also collected data beyond the identification of success factors. As explained in Chapter 4.2, we are interested in finding indicators and assessment criteria for the monitoring and selection of ideas, and also to evaluate the ideation process in its efficiency and effectiveness. Moreover, we used the expert interviews to find detail data concerning special topics highly related to the ideation process, like e.g. stakeholder integration. Moreover, the identified findings will be presented in this thesis in the Chapter 5.1 and 5.2 but also find their way into the subsequent description of the ideation process.

Finally, as with any exploratory research based on the grounded theory strategy, we adopted an iterative research process of data collection, analysis and validation [GLA1967], so that, for example, immediate feedback—especially from internal experts of the case study's company—leads to improvements of the process. A continuous dialogue on the practical applicability in the case study ensures transparency and acceptance of the ideation process at the top management level, which is a very important prerequisite for the successful implementation of the ideation process.

5 Ideation Process Model

5.1 Literature Review

5.1.1 Applied Method

Innovations at a corporate level have to increase the profit of the company sustainably. Therefore the question is: “Which instruments of the innovation management facilitate innovation success?” This is the business-oriented perspective that focuses on the cause of corporate innovation success, the so-called success factors, and which differs essentially from [HAU2011]:

- the natural-scientific / technical perspective: focus on a technical function of the innovation;
- the socio-scientific perspective: search for the social circumstances to prosper innovations;
- the political-scientific perspective: concentrate on objectives and possibilities to influence politically innovation activities and
- the economic perspective: examines the macroeconomic prerequisites and effects of innovation activities.

In the centre of our research work stands obviously the business-oriented perspective. Thus, our literature review exclusively aims for secondary data with business-related background. This limitation is reasonable, because the term innovation is highly interdisciplinary, so an efficient and effective literature review needs a well-defined scope.

To organise the literature review, Creswell recommends a literature map [CRE2009]. This map is a useful approach to explain, “how the proposed study adds to, extends, or replicates research already completed” [CRE2009]. With such a map we have the possibility to summarise our main fields of research interest in an understandable, clear and traceable manner (Figure 5-1).

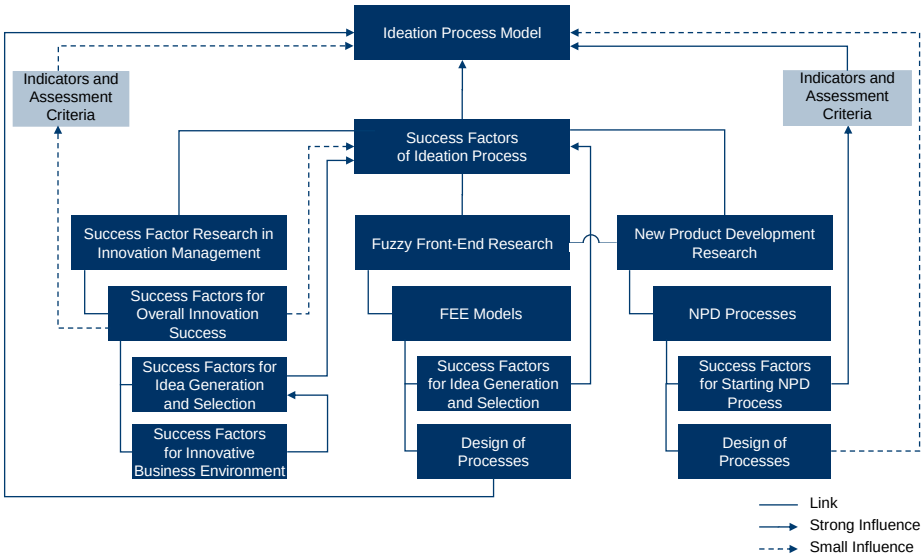

Figure 5-1: Literature Map for the Literature Review

This literature map is a guideline to start our literature review in a well-structured way right from the beginning. First, we want to focus on fuzzy front-end research, which has already been introduced in Chapter 3.2. Here we expect the greatest potential to find the appropriate success factors for the planned mapping to create an ideation process model. Also, we are looking for recommendations for the design of the ideation process in this research field. Strongly connected to the FFE theory is the New Product Development (NPD) research. Here we want to explore the first part of the NPD process to find possible indicators and assessment criteria as already pointed out in Chapter 4.2. Also the typical form of the NPD process may influence our ideation process model. Finally, we want to draw our attention to the literature of innovation management, where the research on success factors is already a well-established research field on its own. Here the main focus is on the overall success of innovation projects. So, we have to break down these findings to our field of research: idea generation and idea selection. The results will help us create our ideation process model by the establishment of an innovative business environment and the achievement of improved ideation and innovation success.

5.1.2 Findings

Basic Findings

Our prior literature research—especially in the field of ideation (see Chapter 3)—reveals that several aspects for the success of an ideation process are already

illustrated or at least implicitly included in the theoretical discourse. Other characteristics are proven facts or common sense in industry practice (see Chapter 6.2). With this solid base from the state of the art we can define some starting points for the creation of the ideation process.

As described in our literature map, our first priority is to extract basic recommendations from fuzzy front-end research. So the first question we are facing is how the ideation process will look like? Beginning with this question of the design of our ideation reference process model we focus on the most typical representation in practice, the stage-gate process.

Reviewing the publications from Cooper, especially his book "Winning at New Products: Creating Value Trough Innovation" that represents the quintessence of his stage-gate research, no final solution for an ideation process can be found [COO2011]. However, we believe that the stage-gate approach will help because it is largely spread within industry, and is also used for all other processes at KSPG. Moreover, our literature research shows that Khurana and Rosenthal's model, which provides us the most influencing content-related foundation, basically follows the stage-gate process structure, which means that their front-end model is divided in several stages combined with decision gates [KHU1997], [KHU1998].

Another important aspect for the creation of an ideation process results from our examination of the New Concept Development Model by Koen et al. [KOE2001], [KOE2002]. The iterative character of this model convinced us to build in feedback loops and alternative entry levels for impulses, opportunities and ideas.

Finally, our lesson learned from the Probe and Learn Process by Lynn et al. [LYN1996] is the fact that allowing making mistakes during innovation activities is essential to learning and creating new knowledge. Through this way of thinking, a change of the corporate environment can be initiated and an improvement of the innovation culture may be achieved. In their exploratory study, Brem and Voigt [BRE2007] point out that innovation culture is a highly relevant aspect in view of personal motivation. One of their interview partners stated that "if an idea gets through into a successful innovation, no one will notice. But if it fails, then you will be blamed for that. So finally, you have no chance to win something". So Brem and Voigt come to the conclusion that a company has to motivate its employees otherwise no above-average results can be expected [BRE2007].

After defining these general assumptions concerning the creation of the ideation process model, we deepen our literature review with regard to success factors of ideation.

Key Success Factors Based on Literature Review

Success factor research of innovation can look back on nearly five decades of history and has established itself especially in business administration, where the success-centred view dominates the understanding of innovation management. Innovations in corporations have to increase profit in a sustainable manner. Based on this purpose, the question arises of identifying the drivers for innovation success [HAU2011].

So the success factor research, which represents an independent, empirically oriented approach, enjoys great popularity in literature. Not only literature of innovation management, also the literature of NPD deals with the topic of success factors, and the lines between these two research fields are often blurred. But the underlying subject of all these studies is exclusively success, which is difficult to define concretely due to its multi-dimensionality and multi-causality. However, numerous empirical studies are engaged in the central issue to find a universally valid concept that helps companies when they risk entering the market with an innovation [HAU2011].

Hauschildt and Salomo give a very profound and also critical summary concerning the research area of success factors [HAU2011]. Also Schmalen gives a very detailed overview [SCH2005]. She examined nearly 60 studies concerning success factors and starts her literature review with the study "Why new products fail" by Cochran and Thompson from 1964 [COC1964]. They already identified as most important factors for product failure: insufficient market analysis, existing product deficits and high production costs.

In literature on new product development and management of technological innovation, Rothwell et al. [ROT1974] pioneered the research of success factors with the SAPPHO study that was based on a comparative analysis of "paired" successful and unsuccessful technological innovations in the field of chemical processes and scientific instruments. The results of the SAPPHO project confirmed that five underlying factors strongly differentiating between innovation success and failure:

- understanding of user needs,
- efficiency of development,
- characteristics of managers,
- efficiency of communications and marketing, and
- sales efforts.

Cooper and Kleinschmidt continued this research work and presented their study, named NewProd, in 1979 [COO1979], [HAU2011]. Through the following years they constantly progress their research work and in 1999

Cooper highlights the following success factors in product innovation that are actionable and controllable [COO1999]:

1. Solid up-front homework – superior definition of the product and assessment of the project;
2. Voice of the customer – high quality marketing actions and dedication to the market and customer inputs throughout the project;
3. Product advantage – differentiated product, unique customer benefits and superior value for the customer;
4. Sharp, stable and early product definition – definition of the product before the development begins;
5. Well-planned and adequately resourced market launch – proficiently executed launch;
6. Tough go/kill decision points or gates during the process – building funnels, not tunnels;
7. Cross-functional teams with strong project leaders – organisation of accountable, dedicated, supported cross-functional teams with strong leadership;
8. International orientation to meet international requirements – building international teams, doing multi-country market research and designing global product (one version for the entire world) or "glocal" product (one product concept, one development effort, but perhaps several variants to satisfy different international markets).

These major studies in the 1970s assist the breakthrough of the success factor research. Since then, an enormous amount of research has gone into studying the factors of innovation success [GRI1996]. Consequently, this high number of studies demands for meta-analyses to cluster the success factors from several single studies [BAL1997], [MON1994], [HEN2001]. Hauschildt and Salomo summarise the results of this meta-analysis as follows [HAU2011]:

Innovations are successful if they

- occur in an innovation-friendly culture that acknowledge the work-shifting nature of the achievements;
- lead to a technologically innovative product, which
- donates the customer a novel benefit, and if
- this product is developed based on professional market research as well as
- introduced on the market after a strategic planning.

This process requires also dedicated efforts of key persons, who preferably already have experience with innovation projects, and professional project management [HAU2011].

Focusing even more on NPD literature, Ernst [ERN2002] gives a very impressive review of the empirical literature regarding success factors of NPD. He summarise the findings of 30 years of NPD research in a compact and structured way, by categorising the identified success factors according to Cooper and Kleinschmidt's [COO1995] five elements for a company's overall new product performance: 1. NPD process (including customer integration), 2. organisation, 3. role and commitment of senior management, 4. culture and 5. strategy. Table 5-1 shortly presents the essential conclusions of Ernst's extensive literature review [ERN2002]:

Category	Success factors of new product development

NPD process (including customer integration)	• **Existence of a formal or informal NPD process** in the company
	Within the process, the following activities and/or contents are of specific importance for the success of new products:
	• **Quality of planning** before the beginning of the development phase; this necessary preparatory work includes:
	  • initial, rough evaluation of ideas
	  • the execution of technical and market-oriented feasibility studies
	  • commercial evaluation of NPD project
	  • description of project concept, target market and the relative increase in benefits of the new product for the customer in comparison with a competitor's product
	• **Continuous commercial assessment of the NPD project** during all phases of the NPD process:
	  • selection of the most promising projects before entering the development phase
	  • a process-oriented and on-going controlling approach can help to decide to terminate a project at certain milestones
	  • the timely and consequent termination of unprofitable NPD projects, which do not meet previously defined goals, is important
	• The **orientation of the NPD process to the market requirements** based on updated market research, which includes:
	  • understanding and evaluation of customer needs
	  • accurate prognosis of the market potential
	  • observation of the competition
	  • execution of test markets
	• No final conclusion about customer integration: There are hints that imply that the **advantage of customer integration increases when it is used in the early and the later phases of the NPD process**.

Organisation	• The project organisation must ensure that the progress of the **NPD project will not be negatively effected by daily routines and/or departmental influences** • **People be specifically assigned to the NPD team** who have enough time to work on the project • The **NPD team should be cross-functional**: members from several

	areas of expertise encourage interfunctional communication and co-operation and as a result can contribute to the resolution of possible interface problems • A **strong and responsible project leader**: this leader must have the necessary qualifications and sufficient know-how, and be able to devote himself sufficiently to the project • **Substantial autonomy to the NPD team**: responsibility for the entire project and not only for parts of it • **Commitment of the project leader and the team members** to the NPD project: this can possibly be fostered by the implementation of project-specific material or non-material performance incentives • **Intensive communication and interactive relationships** among team members during the course of the NPD process
Role and commitment of senior management	• **Senior management's recognition of the value of the new products**, reflected in adequate material support of the NPD programme • **Adequate allocation of resources must go beyond the R&D budget**, since expenditures for market research and market launch of the new product are important for the success of new products
Culture	• An **innovation-friendly climate** in the organisation together with **risk-taking behaviour** • Undertake activities to **encourage the emergence of individuality and creativity** • **Establishment of supporting and motivating elements**, such as the existence of a **systematic scheme for suggesting new products** or the **availability of corporate venture capital** • **Product champion / promoter**
Strategy	• The NPD programme ought to have a **defined and clearly communicated strategic framework** which offers orientation to the sum of single NPD projects • The NPD programme should have **a long-term thrust** • **Senior management should regularly review** whether the aims of the entire NPD programme are being reached

Table 5-1: Success Factors of New Product Development [ERN2002]

All in all, this extensive overview of NPD success factors offers us a large pool of aspects we can revert to. Most importantly, these success factors show us what is important for the overall success of the NPD. So we can derive characteristics for the ideation process model to prepare ideas best before the beginning of the product development on the one hand, and to organise ideation best to achieve success in the following NPD process on the other hand.

Searching more deeply for success factors concerning the fuzzy front end of the NPD process, Khurana and Rosenthal emphasise—based on the findings from Brown and Eisenhardt's research work [BRO1995]—that NPD literature can be organised into three streams [KHU1998]:

1. Rational plan: Evaluation of typical NPD problems and success factors.

2. Communication web: Focus on the impact of organisational structures, roles and processes on information processing and communications effectiveness and overall NPD performance.
3. Disciplined problem solving: Explores how people can work together to effectively participate in the complex problem solving involved in NPD.

In their view, Khurana and Rosenthal state that none of these three streams in themselves can explain the complexity of the fuzzy front-end sufficiently. Therefore they build upon the results from all three streams of research in sum.

Khurana and Rosenthal's findings from in-depth case studies of the front-end practices in 18 business units from 12 U.S. and Japanese companies cumulated in their holistic front-end model (see Chapter 3.2.2) but also reveals on an operational level several approaches that work or does not work in a corporate environment [KHU1998]. Table 5-2 shows the best practices that head towards a holistic front-end model:

What Works	**What Doesn't Work**
Treating product strategy as an explicit input to the front-end	Viewing product strategy as a periodic activity independent of NPD process
Translating product strategy and business goals into explicit product and market objectives	Starting product and market objectives without direct reference to overarching strategy
Ensuring alignment of new product plans, R&D projects, process development, and marketing projections by encouraging communication among R&D, engineering, and marketing functions	Independently engaging in some or all of these activities
Considering the complete set/portfolio of product development projects while making decisions (e.g. explicit linkages across multiple development projects regarding common technologies, market information and allocation of resources)	Making isolated project-specific new product decisions
Considering overall business justification (e.g. consider issues of product distribution as part of product definition)	Viewing NPD as only dealing with the performance of the product
Having a "process owner" to help drive the front-end and give it breadth and scope	Dividing the front-end into a set of independent activities
Matching core team capabilities to the role played by the senior management executive review group	Having executive reviews that are routine exercises
Using a process orientation or a collaborative culture, to ensure that key development requirements are not ignored	Having no formal process, or making the process tot rigid

Explicitly defining the proposed product to clarify concept and secure early agreement	Freezing product definition too early when market changes quicker than new product cycle, or keeping it too fluid such that nobody rally understands it
Adapting the front-end process to the product (incremental or radical), market (market leader or not; consumer, industrial or OEM customer), or organisational (relative experience, maturity and roles of core team and executive review group) context	Following a "cookie cutter" approach to the front-end for all types of new products, markets, or organisational settings

Table 5-2: Best Practices for Front-end Success [KHU1998]

Another very insightful study in the field of NPD literature, which Ernst does not include in his literature review, comes from Zien and Buckler [ZIE1997] who investigated twelve highly innovative companies in the United States, Europe and Japan. One very relevant aspect for our own research work is the fact that Zien and Buckler identified that leaders of continually innovative companies are aware of the fuzzy front-end of innovations and centre this innovation phase in the companies' activities [ZIE1997]. This finding confirms the relevance of our own research work.

Zien and Buckler investigated seven key principles, which are universal but each of the researched companies has its own company-specific implementation practice. Also these factors are not only relevant for the three crucial stages of innovation (the fuzzy front-end, the NPD, and the commercialisation), they also influence sustainably the whole company's innovative capacity over time. These seven factors are shown in Table 5-3 [ZIE1997]:

No.	Principle	Short Description
1	Sustain faith and treasure identity as an innovative company	Leaders demonstrating in every decision and action that innovation is important to their company
2	Be truly experimental in all functions, especially in the front-end	Encouraging purposeful evolution and encouraging employees to try new things
3	Structure "really real" relationships between marketing and technical people	Developing real relationships between marketing and technical people
4	Generate customer intimacy	Generating customer intimacy by encouraging their employees to interact closely with customers
5	Engage the whole organisation	Engaging the whole organisation in understanding that innovation is the fundamental way that the company brings value to its customers
6	Never forget the individual	Continuing to value the individual and set an environment that is conductive to high motivation
7	Tell and embody powerful and purposeful stories	Telling powerful stories that reinforce the principles and practices of innovation

Table 5-3: Seven Key Principles at work in Highly Innovative Companies [ZIE1997], [KOE2002]

This study confirms the findings up to now and reveals principles of highly innovative companies, which generates an environment where innovation and high productivity influence can prosper. This confirms the aspect that an innovation friendly corporate culture is the fundamental for a working front-end process including ideation [KOE2002].

Although there is a very large number of publications concerning success factors for the NPD (including the fuzzy front-end) or the whole innovation process, there is a lack of publications that explicitly refer to success factors for idea generation and idea selection. Mostly idea generation is only mentioned as a success factor of the NPD without further description, see e.g. [COO1984a], [COO1984b], [COO1984c], [COO1995], [COO2006a], [COO2007a] and [BAR1995]. The same applies to idea selection, which is implicitly included in

the success factors of continuous commercial assessment of the NPD project, see e.g. [ROT1974], [DWY1991b], [PAR1994] and [COO2007a].

The research work from Martinsuo and Poskela [MAR2011] is one of the recent studies, which explicitly investigates how the use of evaluation criteria is associated with innovation performance in the front-end of innovation. They found that idea and concept evaluation has an important position in the front-end of innovations because it links product complexity and strategic opportunity. Martinsuo and Poskela's findings confirm the need of a holistic but informal assessment system which is oriented towards the company's development objectives [MAR2011].

Stevens et al. [STE1999] show with their study that selecting creative individuals to work in the early stages of NPD has a positive effect on the NPD process. So it is proven again, that creativity, which can be defined as the process of generating ideas [LAW2001], is an important enabler for ideation and crucial for the overall innovation success [STE1999].

5.1.3 Recommendations for the Ideation Process Model

The overwhelming amount of publications concerning success factors in the field of innovation management and NPD literature including fuzzy front-end research offers us a wide range of starting points how we can create our ideation process based on success factors. Now we have to identify those aspects that must be taken into consideration regarding the ideation process.

The literature deals almost exclusively with the success of new products, without responding to the particularities of ideation within the innovation process, which form the backbone of overall innovation success. Therefore we focus on special parts of the literature to find recommendations which can be easily transformed to ideation because some of the findings—especially in the NPD research—lead to basic conditions which have to be considered in an ideation process.

Based on our literature review we identified several relevant aspects that influence the success of an ideation process. From our point of view, these aspects are of practical importance and are actionable in a corporate environment. These aspects are:

- top management commitment,
- involvement of a broad mass of employees,
- resources for ideation activities in terms of time and budget,
- analysis of market situation,

- leaders of ideation activities,
- integration of internal and external stakeholders in the ideation process,
- interdisciplinary ideation teams,
- promoters of ideas,
- mentors of idea promoters,
- creativity,
- idea communication and (internal) idea marketing,
- systematic and transparent pursuit of ideas,
- practical indicators to monitor and select ideas,
- rewarding schemes.

We like to see these aspects confirmed in the following expert interviews as important, and we want to identify new issues that are really crucial in practice in the view of our interview partners. So we added this list of possible success factors to our interview guideline (see Appendix). For us, the relevance to business operations remains our research focus.

5.2 Expert Interviews

5.2.1 Applied Method

Based on the findings from the literature review, we conducted qualitative interviews with experts in the field of ideation and innovation management to validate and complete our previous results from theory. The aim of these interviews was to survey external experts first, in order to explore current best practices. With the interviews of external experts we wanted to get a stimulus from outside the case study's company to assure learning from others. Internal expert interviews were part of the case study.

Therefore, the selection of the experts for the qualitative survey was done according to certain criteria, which were considered as important for both the research question and for the subsequent analysis of the data. The most important criterion was the professional expertise of the persons concerning ideation and innovation management.

Another broader selection criterion was to focus on best practice examples. Thus, we identified companies from the automotive industry (OEMs and suppliers) but also from other business sectors, like telecommunication

equipment manufacturing, machinery and process technology, chemical manufacturing, and computer services. All these companies are internationally renowned for their innovation powers. This is confirmed by official ratings, like

- Forbes-List of World's Most Innovative Companies [GRE2011],
- Thomson Reuters 2011 Top 100 Global Innovators [THO2012],
- Businessweek/Boston Consulting Group 2010 List of the 50 Most Innovative Companies in the World [EIN2010].

Some of them are Innovation Award Winners [SCH2011], [GEA2011], [KEA2012].

Concerning the sampling of the industry sectors and the respective companies which have come into consideration, we clustered them into three target groups. Within these selected companies we tried to find interviewees who fulfilled our expert profile. Because this research is exploratory by nature, a suitable sample of interview candidates was selected also on the basis of pragmatic reasons, like access and willingness to participate.

In some cases, especially for companies from non-automotive sectors, we found already published secondary data, like e.g. interviews in journals or publications from relevant congresses. Gathering data from these available sources helped us to enlarge our sample and enrich our analysis without additional survey costs and time effort.

Finally, the design of the external expert interviews can be outlined as follows:

Target Group	Scope	Reason for sampling	Data collection procedures	Companies
1	German automotive OEMs	• German automotive industry is regarded as innovation leader in the industry • Access available to interview participants or secondary data	• Interviews • Analyses of various publications from relevant congresses	• OEM 1 • OEM 2 • OEM 3 • OEM 4
2	Successful German automotive suppliers (Tier 1 supplier)	• The case study's company belongs to this segment • Comparison is interesting and necessary	• Interviews • Analyses of various publications from relevant congresses	• Supplier 1 • Supplier 2 • Supplier 3
3	Worldwide recognised innovation leaders, non-sector-specific	• Inspiration from interdisciplinary perspectives on other industries	• Interviews • Analyses of various publications from relevant congresses	• Innovator 1 • Innovator 2 • Innovator 3 • Innovator 4 • Innovator 5 • Innovator 6

Table 5-4: Survey Design of External Expert Interviews

Interviews with experts experienced in ideation and innovation management were semi-structured and based on open ended questions designed appropriately to the topic of the creation and implementation of ideation processes, which represents our research question defined in Chapter 4.2. This kind of survey offers the possibility to fully exploit the experts' knowledge, because it is less rigid than a survey using a completely structured questionnaire based on closed questions [MEH1995].

Basically the interview starts with some icebreaker questions [CRE2009], which are easy to answer and focus on the interviewees' personal background, followed by more detailed questions regarding the following core issues:

- the origin of ideas,
- internal and external sources of ideas (stakeholder integration),
- organisational culture that supports idea generation,
- existence of an ideation process,
- best practices / lessons learned,

- indicators and assessment criteria to measure the success of ideas and to support the selection of ideas,
- success factors of ideation processes,
- interfaces and responsibilities concerning ideation,
- additional processes, methods and systems that are connected with an ideation process.

To support the interviewer in making the interviewed experts address all key issues, an interview guideline had been developed. This guideline also helped compare different interviews and facilitate their analysis without forcing the interviewee to follow the guideline's structure exactly. During the interview it was possible to leave out some questions, to change the order of the questions, to add questions, or to deepen specific discussion points. This demands high competence of the interviewer to receive the relevant information from the experts. The complete interview guideline is presented in the Appendix.

In March 2012, all three members of the research team (see Chapter 4.4.2) conducted face-to-face and telephone interviews. The interview language was German, and face-to-face interviews were carried out at the respective expert's place of work. The confidential interviews were voluntary and the experts were not rewarded for participating. Any identifying information regarding the individual interviewees was not included in the analysis. Participants were given copies of the data collected in order to edit or make any amendments to their responses.

During the interviews, every research team member took detailed written notes highlighting major themes. The interviews were transcribed separately to ensure inter-rater reliability [ARM1997], and compiled into one report.

To close the process of analysis there were two workshops where all three members of the research team met to discuss the findings and map the identified success factors to the proposed ideation reference process model. So the workshops delivered a solid base for the creation of the ideation process, which was further detailed in permanent exchange between the members of the research team and other internal and external experts.

Based on the qualitative research characteristic of flexible reporting [CRE2009], we dispense with descriptive statistical format to figure the finding. In fact, we present our results as textual summary in the following Chapter 5.2.2. Also, for reasons of confidentiality we ensure that it is not possible to draw conclusions about individual companies or interview partners.

5.2.2 Findings

First of all, we want to point out that all our interview partners were very interested in the research topic, as most of them had problems with ideation in the past or still struggling with the generation and selection of ideas. Consequently, our interviews brought us very valuable insights into our core issues (see Chapter 5.2.1), which we like to present in the following.

Origins of Ideas / Stakeholder Integration

In principle, there are two general problems related to ideas: Either there are too many or too few ideas, nothing in between. It seems to be very difficult to achieve a continuous flow of ideas, which can be managed in a practicable manner.

Whereas the first type of problem—the situation of too many ideas—confronts companies with the problem of efficient resourcing and the effective idea selection, the second type of problem—the situation of too few ideas—causes much more effort. In our sample, the problem of too few ideas dominates the corporate reality.

However, one of our interviewees—Supplier 1—stated that since the company which he is working for opens the contribution of ideas to customers via internet, the amount of ideas is so high that it is difficult to handle a prompt feedback to the idea contributors, which is very important in his opinion. The management of such a feedback team absorbs capacities of the existing process.

Based on our prior research and the stakeholder analysis at KSPG [NEU2011d], we confronted the interviewees with our hitherto existing list of potential internal and external stakeholders, and they—especially OEMs and suppliers—confirmed it almost to the whole extend. In their opinion, only sales representatives are not as important as in the past. Most salesmen having had a local office at the customer site had to leave their former exposed position, as the increasing significance of electronic web-based customer portals makes their physical presence obsolete.

The participants drew our attention more to another internal stakeholder group, the after-sales. From the interviewees' point of view, the contact to the end users, like partners from engine repairers and independent workshops, may provide other insightful aspects that may never come into discussion during meetings with OEMs.

In the group of external stakeholders, the government has—beside the customers—the most prominent role for automotive OEMs and suppliers. Regulations concerning CO_2 emissions, financial penalties and legal sanctions are the main drivers for technical innovations. These actual and future

requirements to reducing CO_2 make it indispensable to find innovative solutions to reach these restrictive objectives from legislation.

In summary, we can conclude that the following stakeholders are the most promising sources for ideas in the sector of the automotive industry:

1. *Internal Stakeholders:* executives/management, expert departments (includes R&D, sales, purchasing, quality, manufacturing), external employees, after-sales, cross-functional teams, administration (includes: HR, Legal Affairs, Logistics, Controlling, Finance, Accounting, IT).
2. *External Stakeholders:* customers, competitors, science, society, government, suppliers.

Particularly our interview partners from German automotive OEMs see the need of external stakeholder integration. This is in line with the conclusions from Ili et al. about open innovation in the automotive industry: the Open Innovation aspect is becoming more and more significant for the automotive industry during this decade [ILI2010a].

OEM 2 sees the potential of cross-industry innovations, but actually there are still problems with the practical implementation to integrate external partners. Comparing this result with our findings concerning the innovation leaders in the non-automotive sector, we see that they are one step ahead in the transition from closed to open innovation.

Organisational Culture

This discussion about open innovation leads us directly to the question: "What kind of organisational culture supports the generation of ideas?" With regard to this central question, we first examined our innovation leaders.

The spirit of openness is not only seen as a synonym for external innovative relationships in these companies, rather the contrary: in these companies an open innovation culture predominates. This means that these innovative companies possess a distinctive and open communication. This communication style leads to immediate feedback and constructive discussions of ideas with colleagues or direct hierarchical superiors. At Supplier 2, innovation management represents a competent partner to discuss ideas from market and technology viewpoints. Through this recognition the employees feel that they are taken seriously and are therefore highly motivated in contributing ideas.

We see that in these innovative companies innovation is a subject of every employee, and not only a special group of persons. At Innovator 2 and OEM 4, the idea contribution is part of each employee's (annual) target commitments. Innovator 3 goes one step further in allowing employees to spend a certain proportion of their working time on "free" projects, which facilitates an entrepreneurial spirit and culture.

All in all, we identified that an open innovation culture within the organisation is a major prerequisite in order to implement an effective ideation process.

Existence of an Ideation Process

By asking our interview partners about the existence of an ideation process in their companies, two interviewees answered with a clear "Yes". At Innovator 2 and OEM 4 there is a decentralised organisation structure and management of ideas. But as we investigated these two cases more deeply, we found out that these processes address the continuous improvements of processes within the own company and are linked to the corporate suggestion system. According to our definition of ideation, see especially Chapter 3.1.1, this kind of idea management does not align with our description of the term "ideation". Our focus is on ideas for products, services or business models with commercialisation potential on the market.

In case of Innovator 1, we discovered a very interesting approach. This company started to pilot a system for collaborative idea management called IdeaBoxes in 2008, fully integrated in the company's IT infrastructure and aligned with the collaboration strategy. This method goes beyond the usual suggestion boxes and includes corporate improvements and product innovations. All employees are responsible to submit ideas. Thanks to this bottom up participation, until mid-2010 the company collected over 9.000 ideas, 15.000 comments and about 150 "idea boxes", which represent defined top responsibilities for specific innovation needs. Through viral internal marketing and several focused idea generation campaigns the company has been able to boost such an enormous amount of ideas. Decentralised box managers are responsible for handling ideas within her or his box(es), which includes the evaluation, claiming and awarding of ideas. The ambitious next step is to open up this system to customers and other external partners.

This is a very outstanding example and demonstrates a real exception within our sample of explored practical cases. The majority of our interview partners emphasise that their company does not have any systematic idea generation and selection process dedicated to product idea management. The handling of ideas is more a sporadic task there, occurring only when it is explicitly needed.

Our interviewees from automotive OEMs and suppliers proved the fact that they are very process-oriented, which means strict hierarchies and entrenched structures trap creative work. So they see the need for a structured ideation process because of two main reasons:

1. the processing of ideation is a must, otherwise in their process-oriented corporate culture these innovative activities are not visible for top management, and the needed recognition and resourcing of ideas is not granted, and

2. a process can support as some sort of guidance to structure creative work and help not to forget important steps during the ideation.

Best Practices / Lessons Learned

OEM 2 pinpointed a very important aspect: the not-invented-here (NIH) syndrome [KAT1982]. Our interview partner described that there is a strong resistance in his company against external knowledge. He also stated that, from his point of view, ideas must not focus only on technical aspects. Furthermore he sees the potential in finding the ideal balance between communication potential and technological novelty of an idea. And here he sees the possibility that the adaptation of external knowledge may have a positive effect.

Innovator 4 gives us another very interesting insight. In this company, planning is the challenge and proves to be their best practise. They have a quarterly review process that examines every core product and engineering area against product performances, financial data and the strategic positioning. This review leads to improved planning and possible shift of finance. To facilitate these allocation decisions, no business units exist in this innovative company. From their point of view, the problem with conventional business unit managers is that they defend their resources and are not willing to share them with other business units. At Innovator 4 there is a kind of trustful mindset amongst the employees, because they are confident that if they need the capital and workforce for a promising project they will get it immediately.

These two lessons learned may represent very particular cases but they imply that internal obstacles like the NIH syndrome have to be avoided, or in the extreme case a company has to think about long-established organisational structures to become more innovative. Thinking out of the box helps leverage creativity and the birth of ideas.

Indicators and Assessment Criteria

When we asked for indicators and assessment criteria to measure the success of ideas and to support the selection of ideas, Supplier 1 answered: "Everything depends on the right selection." He wanted to express that assessment criteria are important. In his eyes, a workable filter during the selection of ideas is to ask the following questions:

- What does the customer (OEM, end-user) need?
- What do the others (competitors) do?
- What kinds of (technology) developments exist?
- Are there legal restrictions?

Furthermore, Supplier 1 added that during the selection of ideas, methods like portfolio and/or SWOT analyses, OEM surveys, expert interviews, and workshops concerning "Top 10 Ideas" might possibly be helpful.

Innovator 6 brought assessment criteria in the centre of our attention that ensures the strategic fit of the ideas. This means that the indicators have to measure if the new product ideas are able to fulfil the company's overall strategic objectives. Therefore we wanted to know, what possible indicators for evaluating an idea's ability of strategic fit can be.

Our interview guideline includes a list of several possible indicators, which are already used at the author's company to some extent. The discussions with the interviewed experts gave us the possibility to identify the adequate assessment criteria to evaluate the strategic fit of an idea. The result is the following list of indicators, which are complemented with the related core questions:

- *Market area/technology field:* Will the company's strategy be fulfilled?
- *Technical feasibility:* How big is the technical risk for the company?
- *Corporate risk:* How big is the corporate risk for the company?
- *Required know-how:* Is the relevant know-how already available in the company?
- *Required resources/capacities:* Can internal resources/capabilities of the company be used or are external resources / capabilities needed?
- *Required workforce:* How much workforce is required for the project?
- *Budget requirements:* What is the required estimated budget?
- *Advanced performance (basic input/expense):* What amount of necessary input in terms of resources, costs, investments and any acquisition costs for product and process deployment must be provided?

The expert interviews helped us also with the clustering of the remaining assessment criteria from our list. We decided to name this assessment dimension "Future Potential". These indicators and related questions are in particular:

- *Level of innovation/novelty degree:* What is the distance of the innovation over previous solutions? Note: The level of innovation depends on whether the new product is a market, a business or a production novelty.
- *Exclusiveness:* How can the patent situation be assessed with respect to property rights/patents?
- *Conformity with technology trends:* Are there any general or legislative required changes of technology noticeable in the market?

- *Market reach:* Which markets can be reached with the product?
- *Sustainability of the technical solution:* Are the solutions long-term or short-term solutions for the market?
- *Need for the technical solution:* How strong is the pressure to find a solution?
- *Competitive environment:* How big is the competition?
- *Speed of innovation:* How high can the (re-) action speed of the company be rated?

The search for useful indicators and assessment criteria to evaluate and select ideas is a very complex and complicated topic. Although there is a high agreement of the importance of such a selection, our interviewed experts cannot provide a satisfying solution. They also have problems with the evaluation of ideas, due to missing assessment criteria and transparency of decision-making.

Success Factors of Ideation Processes

The identification of success factors of ideation processes represents our main focus within the expert interviews. In order to find factors which we can map to our reference process model of ideation, we first asked the interviewees the open-ended question: "According to your experience and/or considerations, what are key success factors of an ideation process?" This should encourage the interview partners to talk freely and to reveal more information voluntarily. In the second step, we confronted them with our list of possible aspects derived from the literature review and presented in Chapter 7.1.3.

The first question and answer session with our interviewees showed very clearly that top management commitment has a very high rank amongst the critical success factors of ideation processes. Without exception, all the interviewed experts agreed to the fact that top management commitment is indispensable to enforce innovation activities. Two experts declared that they had seen several ideas fail due to lack of a visible commitment of top management. Without the top management commitment, the resources for ideation activities in terms of time and budget will not be granted.

Another very important success factor identified in particular at German automotive OEMs is the fact that ideation needs to focus. A well-defined strategic orientation has to be visible for everyone who is involved in ideation. A cohesive strategy has to describe the future vision for the company's products and services. That strategy needs to state clearly the long-term perspective that all participants in the ideation process are in line with this future focus. This strategy-oriented approach needs open lines of communication that are regularly and consistently managed. Additionally, it is

important that market changes and the evolution of the company's new products make it necessary to revise the strategy regularly. This flexible modification of strategy must not be underestimated. Otherwise there is the threat of losing differentiation attributes with respect to the competition. Creating and sustaining Unique Selling Propositions is a crucial objective of the interviewed OEMs, in particular because of their global market presence.

Ideation needs a good prerequisite. This includes, from our interviewees' points of view, diligence work in form of analysis of the market situation, a competitive environment, customer needs, technology trends, current and future legislation, etc. OEM 1 sees in this preparation the prerequisite to target and optimise idea generation.

All the involved interview partners agreed that a systematic and transparent pursuit of ideas is needed. "Ideas may not disappear without a trace", stated OEM 1. This leads to the assumption that especially the generation of ideas must involve a broad mass of employees and integrate external stakeholders as well. OEM 3 pointed out: "Creativity evolves from Networks."

However, networking and stakeholder integration needs clear structures including roles, responsibilities, mandates, reporting lines, etc. Leveraging interdisciplinary teams with strong leadership may influence the idea generation positively. For OEM 4 this aspect seems to be a promising factor. "Someone has to have the lead to pull ideas through", added OEM 2. A clear role allocation also leads to a successful ideation. These roles are: leaders of ideation activities, promoter of ideas and mentors of idea promoters. "But it is important", Innovator 4 pointed out, "that a common mental model exists between these roles and that they adhere to the same clear process model."

Our interviews also revealed the fact that to facilitate creativity, it is a vital success factor to balance between specific and well-defined problem solving activities, in form of guided ideation, and giving the employees their freedom of generating ideas without corporate specifications. This last point will enable ideas out of the box but requires special budget.

To solve the problem of budget allocation during ideation, OEM 3 and Innovator 6 see the need for a competition spirit among ideation teams/idea contributors and their generated ideas. There has to be competition for the budget, where only the best ideas receive the needed financial resources. This demands for entrepreneurship, because only if the ideas contributors think like entrepreneurs enforcing internal idea marketing, their ideas will obtain the recognition they deserve.

The experts agreed on the importance of idea communication as a bidirectional exchange:

1. From the idea contributor: integrate ideas into a story to gain attention and highlight customer value and marketing aspects, and
2. to the idea contributor: assure quick response times to idea submissions and guarantee a systematic and transparent follow-up of ideas.

Regarding idea selection, the interviewed experts emphasised again the need for practical indicators to monitor and select ideas. For OEM 1 and Innovator 6 a comprehensible decision-making is essential.

Asked about rewarding schemes as a success factor, the experts did not prioritise this aspect very highly. In their understanding, it is crucial to motivate employees, but not only by financial rewards. They stressed that rewards are also about recognition and being able to do satisfying work that challenges the mind and allows setting free their creativity.

Interfaces and Responsibilities

As already seen in our discussion with the experts about the success factors of ideation, the most important interface is the top management. For the interviewees, a regular involvement of top management is crucial for the success.

However, it is also essential to identify all internally responsible persons and bring them together in regular time intervals. Such exchange should be leveraged by dedicated meetings where top management participates and makes decisions.

Moreover, the experts highlight the fact that each ideation team needs a leader who can act as the moderator and reporter. The personal communication and the continuous flow of information and knowledge among different actors of the whole ideation process is thus an essential element.

The challenge of these special part of the ideation process is to nominate the appropriate experts from different fields for several parts of the entire ideation process and define their specific responsibilities. Possible difficulties, maybe due to personal reasons, have to be resolved to achieve an output-oriented and targeted cooperation.

Additional Processes, Methods and Systems

Finally, we tried to identify additional processes, methods and systems that are connected with an ideation process. In particular, we were interested in idea generation tools—especially creativity techniques—that are useful for practical execution.

Prior research by one member of our researcher team (see Chapter 4.4.2) was focused on the usage well-established idea generation tools in automotive

industry practice. We used this list of idea generation tools from his survey, which is also based on a qualitative research approach based on expert interviews, in our interview guideline (see Appendix).

Our interview partners confirmed that they were using several of these tools. However, they stressed the fact that they used it very sporadically and only when it is needed. So they are far from mastering these tools at their full scales. The interviewees would appreciate regular lessons or seminars teaching them to correctly use such tools.

In addition, Supplier 2 uses the problem-solving method TRIZ [FEY2005], [CAV2001] and [CAV2009] as a helpful structure to come up with inventive (and probably innovative) ideas. Also, they are following and working with lead users [HIP1999] to generate leading edge ideas.

5.2.3 Recommendations for the Ideation Process Model

Globally speaking, these expert interviews validate and enrich our previous key findings from literature review. Our discourse with experts in the fields of ideation and innovation management helped us to identify best practices and to derive success factors from them.

When we look at the multitude of identified success factors that we found in our literature review and expert interviews, we can observe that a clustering of the factors based on their frequencies is possible and helpful in the practice and business context. With regard to our ideation reference process model we want to group the success factors into prerequisite, generation, and selection aspects of ideation. This summary of the success factors represents the fundamental objectives of ideation and is a very good starting point for defining the stages of our ideation reference process model.

5.3 Derivation of the Ideation Process Model

5.3.1 Key Success Factors of the Ideation Process Model

Our extensive literature review in the principle subject areas of innovation management, fuzzy front-end research and NPD research, as well as our examination of best practice examples from the automotive industry and other worldwide recognised innovation leaders result in the identification of key success factors for an effective ideation process. Within our previously identified key aspects of ideation—i.e. prerequisite, generation and selection—

we achieved a further clustering of the factors to simplify the targeted mapping in the ideation reference process model (see Chapter 5.3.2).

Finally, we summarise our findings from literature review and expert interviews under the following six main success factors, which are actionable and promising for the creation of an ideation reference process model:

- Success Factor No. 1 (S1): *Ideation starts at the top management.*

  Top management call and clear top management commitment to ideation is absolutely essential and must be clearly visible for all employees.

- Success Factor No. 2 (S2): *Ideation needs a clearly defined focus.*

  Systematic analysis of the company's total situation and environment for the identification of areas of action increases the effectiveness during the generation and selection of ideas.

- Success Factor No. 3 (S3): *Ideation happens in networks.*

  Targeted integration of internal and external stakeholders prevents "me-too-innovations" and increases the innovation potential.

- Success Factor No. 4 (S4): *Ideation demands creativity.*

  The promotion of creativity and its integration in corporate processes enhances the quality and quantity of ideas.

- Success Factor No. 5 (S5): *Ideation needs entrepreneurship.*

  Competition between ideas and their marketing in the company raises the level of maturity and the quality of ideas.

- Success Factor No. 6 (S6): *Ideation requires organisational orientation.*

  Target–oriented decision-making processes with transparent evaluation criteria enable the communication and conversion of ideas.

All the above listed success factors contribute to creating and reinforcing an organisational culture of Open Innovation, facilitating the integration of numerous stakeholders in the ideation process.

Especially in business sectors where the Closed Innovation paradigm dominates R&D processes including ideation, a change in mindset toward Open Innovation represents an essential breakthrough to increase innovative power [ILI2010a].

5.3.2 Global Structure of the Ideation Reference Process Model

Our main objective for the creation of the ideation reference process model was to achieve a clear and simple mapping of the identified six key factors to stages and gates of the ideation process, in a way that each of these elements can also be implemented in any specific organisation. The advantage of leaving the model broad is that this allows any company to tune their existing ideation processes to the most effective elements instead of blindly copying the whole ideation reference process model.

For this purpose, we have created the process based on the three fundamental aspects of ideation, which we derived from our research findings (see Chapter 5.2.3) [NEU2012]:

1. *Prerequisite* covers all the activities expected from top management level to set the right frame for the whole ideation process, like internal and external analysis, definition of business unit innovation strategy, commitment of top level management visible for all employees, agreement on the ideation targets and priorities and commitment to available resources.
2. *Generation* is the active execution phase. Here all the ideation activities are fully devoted to facilitate the generation of ideas to the maximum. These activities include the creation of ideas in networks of internal and external actors, usage of creativity techniques out of the company-specific ideation tool box, guided ideation and the speciality of "Wild Card Ideation".
3. *Selection* consists the idea assessment, idea communication and the transfer of ideas to the subsequent NPD. This stage is dedicated to find and campaign the best ideas for the upcoming development process.

These three main elements correspond to the stages of our ideation reference model. Each phase has its specific ideation activities, which also occur from our research of best practices and represent in their core also success factors that have to be implemented in order to fulfil the related gate requirements and to pass to the next stage. Taking all this into account during the creation of the process, we have finally designed the ideation reference process model as shown in Figure 5-2.

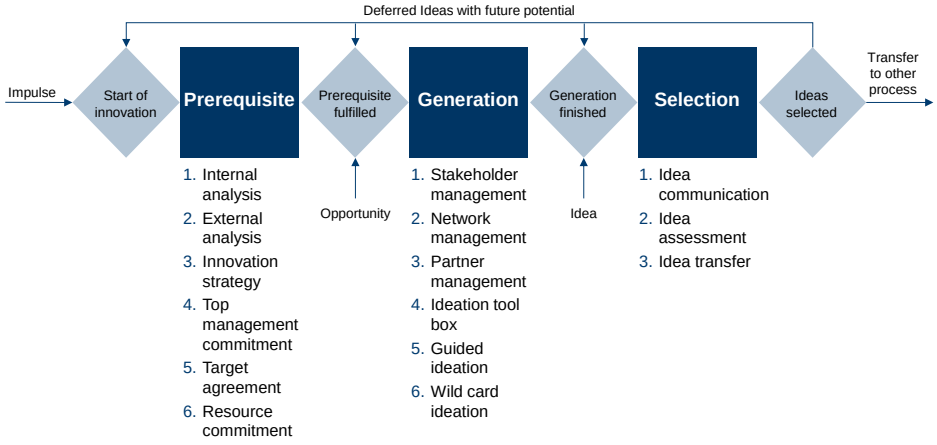

Figure 5-2: Ideation Reference Process Model

Table 5-5 explains our mapping and represents an overview of all the three phases including the activities which have to be complete in each step, as well as the corresponding key success factors that they address.

Ideation Process Phase	Ideation Activities	Success Factors
Prerequisite	Internal Analysis	S1 and S2
	External Analysis	
	Innovation Strategies	
	Top Management Commitment	
	Target Agreement	
	Resource Commitment	
Generation	Stakeholder Management	S3 and S4
	Network Management	
	Partner Management	
	Ideation Tool Box	
	Guided Ideation	
	Wild Card Ideation	
Selection	Idea Communication	S5 and S6
	Idea Assessment	
	Idea Transfer	

Table 5-5: Mapping of the Key Success Factors with the Phases of the Ideation Reference Process Model

It is very important that this framework is implemented in a way that it allows for the flexibility required to leverage the intrinsic dynamics of idea generation, i.e., ideas coming up at any stage of this process must be handled efficiently.

Also, ideas that are not selected have to be maintained in a way that they can participate in future selection phases: ideas not relevant today may become relevant tomorrow [NEU2012]. These assumptions correspond to the findings documented in Chapter 5.1.2, where the iterative character of processes is emphasised by authors like e.g. Koen et al. [KOE2001], [KOE2002].

In the following chapters we will describe each of these phases and their associated activities, for which our model does not seek to impose neither a particular timely order nor a prioritisation, as these will depend on the specific corporate context.

5.4 The Prerequisite Phase

The prerequisite phase includes all the effort that is invested in the initial part of the ideation process. For the reference process model, this will include everything from the first external and internal analysis through to the top management commitment. It will also include the definition of business unit innovation strategies and the target agreement. Very important is also the commitment to the resources needed to realise the upcoming innovations.

The prerequisite phase is a fundamental element because it mirrors the innovation strategy as well as the culture and organisation of a company. It helps to set the framework for a commonly shared mental model [ALB2011] and [ALB2012] amongst the actors of the ideation process. Essentially, the prerequisite phase is about preparing the following process phases and priming the company for the necessary next steps of inspiration and creativity. Creativity has to be fed, and without any input, no output can be expected [MAH2011].

Most of these prerequisites needed to pass on to idea generation should be available to a large extend from strategic activities that are already carried out as part of existing processes, and are therefore not to be seen as additional charge imposed by the new ideation process [NEU2012].

5.4.1 Internal and External Analysis

The whole ideation process starts with an impulse. Because this process is embedded in an interactive organisational environment, these impulses can come from the internal or external environment. According to the influencing factors defined by Koen et al., these impulses can be based on [KOE2002]:

- the corporation’s organisational capabilities,
- customer and competitor influences,

- the outside world's influences, and
- the depth and strength of enabling sciences and technology.

To be aware of possible opportunities the internal and external analysis of these influencing factors is vital [KOE2002]. Already in the year 1964 Cochran and Thompson saw the need for sufficient market analysis to guarantee the new products' success [COC1964]. Subsequent studies have proven this assumption [ROT1974], [COO1983], [DWY1991a], [DWY1991b] [BAR1995], [CAL1997], [PAR1994], [LYN1998a]. Therefore this initial screening activities mark the start of the prerequisite phase of the ideation process.

The internal analysis has to focus on the check of core competencies and capabilities first. This is crucial, because these organisational core competencies and capabilities determine the following identification and analysis of internal impulses as well as the effort on using external opportunities [KOE2002]. This internal analysis has to support the identification of the company's strengths and weaknesses and the related current resource situation.

The definition of the current market situation is the core task of the external analysis and the information of the market must be observed and explored for usable ideas. The identification of customer requirements helps to formulate customer needs and consequently starting points for the idea generation. Also the analyses of competitors' approaches may inspire and support changing previous manners in the company to solve problems. The analysis of the outside world includes government policy, environmental regulations, and laws concerning patents. Socioeconomic trends affect the ideation process as well [KOE2002].

The stimulus for new ideas based on internal and external research with the aim to commercialise new know-how is called technology push [BRE2009]. The identification of new enabling technology fields, which can be repeatedly used in a product or service, is an important issue within the ideation process [KOE2002].

Highly technology-driven sectors like automotive, are obliged to monitor and actively influence technologies that decide about market success. Therefore the stakeholders responsible for ideation have to analyse technologies with respect to their further implementation, new arising (substituting) technologies have to be identified in time, and assessed for their commercialisation and threat potential. This also implies the need for observing—and probably even participating in—fundamental research.

In the course of this analysis the extraction of knowledge is essential. Therefore the prerequisite phase has to deal with the procurement, storage and utilisation of new technological knowledge, similar to the discipline of technology

management [BRO1999]. Only through the identification of gaps in the current product portfolio and—based on these findings—clearly communicated priority fields of action, it is possible find new ideas to protect the company's competitiveness [COO1999].

5.4.2 Innovation Strategy

Ideation needs a clearly defined focus. This was one of the major findings from our expert interviews. Griffin and Page support the conclusion that the presence of a clear strategy has a positive influence on the success of new products [GRI1997]. Therefore the definition of the company's innovation focus that is aligned with the overall company's core mission and values is inevitable and a major part of the House of Innovation [DIE2006], [ENG2010], presented earlier in Chapter 2.3. This strategic focus helps reduce cost and time effort during the creation and realisation of ideas [MEY1997].

Innovation strategy has a leading and controlling function and leverages the effectiveness of the ideation process [CLA2012]. The core of an innovation strategy is a set of innovation guidelines and innovation search fields. These innovation guidelines and innovation search fields provide a framework for the ideation process concerning the following key points [CLA2012]:

- They ensure that all innovation activities are aligned with the overall corporate strategy and make a supportive contribution to it.
- They channel and focus the idea generation. Thus, for example, innovation search fields can be transformed directly into tasks of an ideation workshop.
- They can be used as assessment criteria for ideas, especially in the idea selection gate.
- They help design products or services aligned with the market needs.

In the context of innovation strategy, a company's core competencies play a major role. Prahalad and Hamel [PRA1990] argue that in order for companies to perform successfully in the long run, they have to stick to a limited set of distinctive technological capabilities in which they can obtain specialisation and synergistic economies, and through which they would be able to deliver an ongoing flow of innovations to multiple product markets. The paper had a powerful impact on corporate mangers' general conception of what constituted the foundation for sustainable competitive advantage in large technology-intensive companies.

Apart from these internal factors of a company, innovation strategies have to take into account external factors as well [CON2001]. These external factors are [PEA2011]:

- *Remote factors* are beyond the borders of a company like economic, regulatory, social, political and ecological variables.
- *Industry factors* influence the company but the latter has only limited control on these variables, e.g. the competition and the supply chain.
- *Company factors* are operational forces of a business which can be most influenced by a company such as customers, suppliers, competitive position and creditors.

Therefore, any innovative activity has to take into consideration the underlying interdependencies as well as the company's competitive strategy. Central factor of competitive strategy is the choice of the market position and its realisation [POR1980]. A detailed description of the creation of an innovation strategy including practicable approaches and methods can be found in the publication of Clausen et al. [CLA2012].

5.4.3 Top Management Commitment

Even the best ideas need support and commitment from the management board. All the interviewed external experts agreed on this. Our interviews with internal experts at KSPG also revealed that this commitment is essential to push the development of new products. One of our internal experts stated: "Based on my experiences, it might be important that the top management provides a statement regarding the most important innovative topics, which they really want to be realised." Top management commitment can be seen as the prerequisite for establishing the basic conditions for innovative activities to be carried out and for employees to understand their responsibility and to be encouraged to think beyond the status quo.

Regular innovation board meetings helps to implement the objective of top management commitment, as top management is supposed to commit to innovation strategy and innovation priorities there. Ideation calls and timelines are directly derived from these outcomes, and have to be communicated in the entire organisation.

Too often good ideas are not pursued because there are no influential promoters in the company. Finding promoters having the balanced combination of power and knowledge is also a prerequisite for the success of an idea [GAS2011].

5.4.4 Target Agreement and Resource Commitment

During the previously mentioned innovation board meetings it is also possible to find an agreement on the targets of the whole ideation process. To guarantee the success of the ideation process it is necessary to define ideation targets and associated assessment criteria and key performance indicators to measure the results in relation to the initially declared objectives.

The gates of the ideation process have to be defined in a way that they include results that are necessary for the business decision "Let's start the next phase of the process – not more, not less." [GAS2011]. This transparent evaluation approach will help to initiate some sort of ideation contest, as idea contributors are aware of the fact that only those ideas will be implemented which pass all gates by fulfilling all previously requirements and evaluation criteria.

The prerequisite phase also has to assure that fundamental resources are available for the subsequent idea generation phase. This is crucial, because effective resource management helps increase the number of ideation initiatives and improve the probability of stimulating idea [LAW2001]. A solid prerequisite has to enable a connected and inspiring environment for ideation.

5.5 The Generation Phase

The major goal of the generation phase is to create as many ideas as possible. Essential activities to be carried out during this execution are the following:

- stakeholder management,
- expert network management,
- partner management,
- selection and deployment of ideation tools and methods, like e.g. guided ideation, and
- creation of a spirit of challenge and competition (wild card ideation).

Throughout the ideation generation phase there has to be good balance between freedom for creativity and relevance to the clearly communicated innovation targets, as well as the defined indicators and assessment criteria. Only this will assure that ideas will mature and propagate to the final selection phase [NEU2012].

5.5.1 Management of Stakeholders, Networks and Partners

Where do new ideas come from? Which internal and external sources are especially suitable for ideation in general? – In many organisations, innovation management is an isolated unit lacking the integration of all important internal and external stakeholders in the early phase of the innovation process.

Therefore the implementation of a company-wide ideation management function, which organises the comprehensive and profound interactions with other corporate division members and the business environment, is the first essential step to lever the generation of ideas. The integration of stakeholders, the establishment of ideation networks and the opening of the ideation process to partners will also positively influence the following phase of the ideation process, idea selection (see Chapter 3.3).

The management of networks comprises activities such as the establishment of ideation networks, non-strategic know-how sharing and integration, as well as structuring external know-how. By its very definition, Open Innovation leads to networks of people, companies, and other different kinds of organisations. Several different kinds of initiatives are typical in such networks, such as:

- contracting specialists,
- Joint Ventures with other companies,
- co-developing products with suppliers,
- subcontracting services,
- licensing technology,
- alliances with universities and research institutes,
- participating in broad networks to coordinate innovation,
- involving existing and future customers in idea and feedback networks,
- trend identification from semantic analysis of social and knowledge networks.

The enrichment of the linear stage-gate model with aspects of interactions resulting in the creation of knowledge and learning will improve innovation power.

Our expert interviews help us identify internal and external stakeholders, which have relevance for the automotive industry in particular (see Chapter 7.2.2). These new findings in combination with our prior research [NEU2011d] enable us to present a list of relevant stakeholders for the automotive industry sector concerning ideation. Figure 5-3 depicts the most promising stakeholder groups in association with the ideation process model.

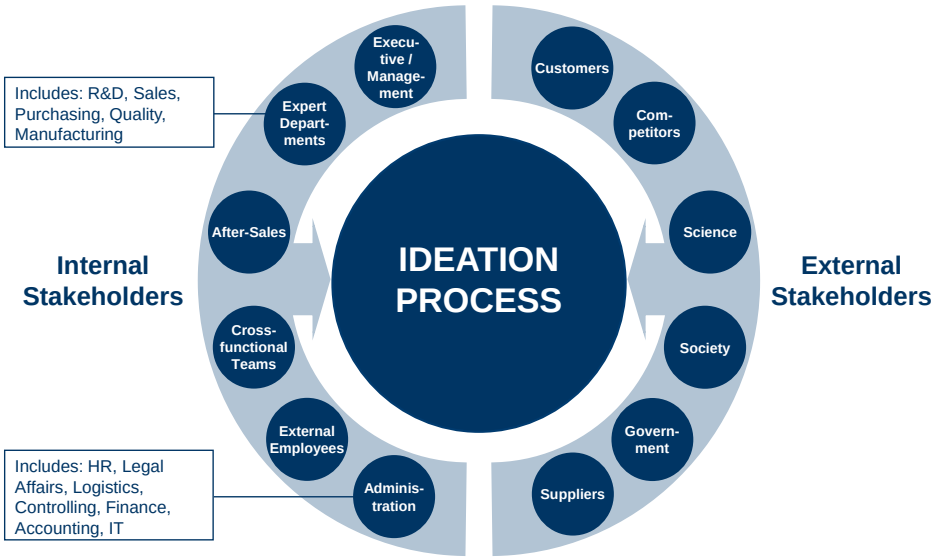

Figure 5-3: Integration of Stakeholders in the Ideation Process

Based on this focus on crucial stakeholders, we want to continue our stakeholder analysis more deeply according to our assumptions in Chapter 2.4.2, first looking at internal stakeholders, then to external stakeholders.

When it comes to product innovation, the most successful companies are those whose organisational structures foster the development of knowledge through formal research and development processes and the development of knowledge based on experience, practice, and interaction between employees, clients, and suppliers [JEN2007]. Jensen et al. [JEN2007] found that the organisational configuration of companies that develop knowledge based on practical experience and interactions among employees present the following characteristics:

- existence of interdisciplinary workgroups;
- role integration around specialties and processes, rather than departments;
- flexible boundaries between departments;
- cooperation with clients.

Thus, the establishment of an organisational framework which facilitates the involvement of all internal stakeholders upfront in the generation stage but additionally in all ideation process stages according to their contributions, has to take into account

- the particular interests and value understandings of each stakeholder group,
- their desired roles within the organisation in the ideation process,

- their particular involvements, as well
- as methods and tools that are adapted to and support their involvement.

Based on our previous considerations [NEU2011d] we revised the internal stakeholder analysis for all the groups shown in Figure 5-3. The results are summarised in Table 5-6.

Internal Stakeholder Group	**Interests/ Values**	**Roles**	**Involvement**	**Methods/ Tools**
Executive	• Strategic objectives • Business success • Leadership • Corporate culture	• Decision-making • Providing resources • Definition of core competencies	• Important involvement in prerequisite phase • Operational direction	• Decision-making body • Technology Roadmap • Scenario techniques
Management	• Strategic and operational objectives • Commercial success • Methodical thinking	• Supporting the idea generation • Evaluation, selection and controlling of ideas • Assessment of idea performance • Coordination	• Involvement in idea generation and idea selection phase • Motivation of employees • Assignment of key roles • Implementation of strategic objectives	• Review meetings • Market analyses • Information exchange • Knowledge management
Expert Departments (includes R&D, sales, purchasing, quality, manufacturing)	• Operational and functional objectives • Functional and technical know-how • Customer focus • Market knowledge • Organisational know-how • Networking	• Idea contributors • Evaluation of ideas as experts • Collection of information and ideas from external stakeholders, like customer or supplier • Implementation of ideas • Contributing customer needs, competitor situation or supplier insights • Door opener	• Involvement in all innovation process phases • Realisation of ideas • Commercialisation of ideas	• Idea generation activities and processes • Customer or supplier meetings, workshops and seminars • Customer relationship management systems • Inventions
After-Sales	• Face-to-face with end users • Product knowledge	• Idea contributors • Under-standing product specification • End-user insights	• Involvement in idea generation phase	• Idea generation activities and processes
Cross-functional Teams	• Problem focus • Interdisciplinary team-work	• Idea contributors • Evaluation of ideas as experts • Special task forces	• Involvement in idea generation phase	• Creative techniques • Inventor circles

External Employees	• Project objectives • Task focus • Output oriented	• Idea contributors • Stimulus from outside • Outside view	• Involvement in idea generation phase • Temporary restricted relationship	• Idea generation activities and processes • Consulting meetings
Administration (includes: HR, Legal Affairs, Logistics, Controlling, Finance, Accounting, IT)	• Operational and functional objectives • Task-related abilities	• Evaluation of ideas as experts • Implementation of ideas • Acceptance support	• Involvement in all innovation process phases • Realisation of innovations	• Idea generation activities and processes

Table 5-6: Overview of Internal Stakeholders' Participation in the Ideation Process

To support new product development and to accomplish the goal of successful ideas, the ideation process has to involve external stakeholders. Several industries, among which the automotive industry, are only at the transition from classical so-called "closed" innovation organisations to open innovation [ILI2010a]. The multitude and variety of external stakeholder groups potentially involved in this movement is extremely large, very much driven and supported by increasingly powerful and pervasive networking facilities.

According to the external stakeholder groups shown in Figure 5-3, we attempted to identify some key characteristics of involvement in the ideation process. Table 5-7 shows the findings of the external stakeholder analysis.

External Stakeholder Group	**Interests/ Values**	**Role**	**Involvement**	**Methods/ Tools**
Customers	• Fulfilment of needs • Additional benefits • Low price, high value	• Idea contributors • Defines development-related functional requirements and contract specifications • Providing financial resources	• Very important involvement in all ideation phases • Key idea contributors • Acceptance of innovations	• Lead user innovation [HIP1999] and [THO2002]
Competitors	• Strategic objectives like Pioneer, Fast Follower or "Me-Too" • Commercial success • Defending and improvement of own market	• Motivation for development changes and innovations • Realignment of strategic objectives • Driver for strategic alliances	• Involvement in all innovation process phases • Influence of overall innovation strategy • Compete with best-in-class to leverage	• Direct talks • Competitive intelligence [MIC2006b] • Joint Ventures

	position		learning and excellence	
Science	• Basic research • Methodical thinking • Expert know-how • Conceptual groundwork	• Idea contributor • Evaluation of ideas as an expert • Trend prediction	• Important involvement in idea generation and idea selection phase • Supporting innovation plans • Testing of innovations	• Knowledge management • Sponsoring of university chairs • Master and PhD thesis projects • Conferences • Scanning new technology publications • Science-industry cooperation
Society	• Socio-cultural environment • Definition of visions and values • Networking • Lobbying	• Visionaries • Indicator for market trends • Contributing overall needs and environ-mental insights • Evaluation of ideas as an expert	• Involvement in all ideation process phases • Promotion of ideas • Influence of the sustainability of innovations	• Knowledge mining techniques [ASA2008] • Working groups • Contact with opinion leaders and reference groups • Publications from industry associations • Monitoring media, especially internet research or patent research
Government	• Prosperous economy • Legal-political framework • Regulatory authority • Administration	• Governs development-related regulatory requirements • Funding innovation projects	• Involvement in all ideation process phases • Regulate and control innovations	• Scanning new technology regulations • Attendance in national and international fund programs for innovations
Suppliers of physical goods or informa-tion (like consul-tants or research firms)	• Long-term relationship and cooperation • Business success • Information exchange • Expert know-how in their field of activity	• Idea contributors • Determine the realisation of innovation through materials, equipment etc. • Consulting • Problem solver during realisation	• Involvement in all ideation phases • Realisation of ideas	• Meetings and direct talks • Contract negotiations • Usage of provided information services

Table 5-7: Overview of External Stakeholders' Participation in the Ideation Process

The integration of internal and external stakeholders and the organisation of networks and partnerships is a very essential part of our ideation process model. This demands at the same time a very good understanding of the stakeholders. The systematic stakeholder analysis as presented in the previous explanations can help to manage stakeholders, networks and partnerships. It is applicable to several different industrial organisations as it is based on the social principles identified in [MER1997] and evoked in Chapter 2.4.2 for each stakeholder group.

5.5.2 Ideation Tool Box

The method, tools and techniques that a company uses to generate ideas are the essence of this element of the ideation process. For a formal structured ideation approach, creativity tools and techniques (e.g. brainstorming, six thinking hats, etc.) as well as problem solving techniques (e.g. TRIZ, patent mapping, etc.) may be utilised. Alternatively, informal opportunity identification activities may occur which include ad hoc sessions, discussions during coffee breaks, individual insights, or edicts from senior management. Opportunity Identification in many cases precedes active idea generation, but may also be an enabling step to link an unanticipated notion to a business or marketplace need that was not previously identified [VER2007a].

The genesis of ideas cannot be left to chance during a structured ideation process. Thus, it is important to identify the most promising ideation activities that can stimulate creativity actively. Related to this topic, an enormous amount of publications exists that deals with the subject of techniques, activities, and processes for generating ideas. Glassman gives a very profound overview over these existing methods and tools [GLA2009]. An outline of many ideation methods can also be found in the book from Cooper and Edgett [COO2007b].

A very recent study—and a very insightful publication for our purpose—was published by Cooper and Edgett [COO2008], who tried to find an answer to the question: "Ideation for Product Innovation: What are the best methods?" Their study looked at 18 different ideation methods with the objective to determine how extensively each ideation method is used (the popularity of the method) as well as to gauge management's perception of the effectiveness of the method in generating excellent, high-value new product ideas. A total of 160 companies took part in the study conducted in 2007 [COO2008].

Figure 5-4 presents the popularity and effectiveness of each of the 18 methods in a magic ideation quadrant diagram. The popularity is measured by the percentage of firms that extensively use each method (usage was captured on a 0-10 scale; "extensive users" are those that checked the top third of this 10-point usage scale). Rated effectiveness of each method is presented as a 0-10 scale, but only for users of that method. Ideation methods that are both popular and effective are in the upper right quadrant, approaches that are not too popular and rated ineffective are in the lower left quadrant [COO2008].

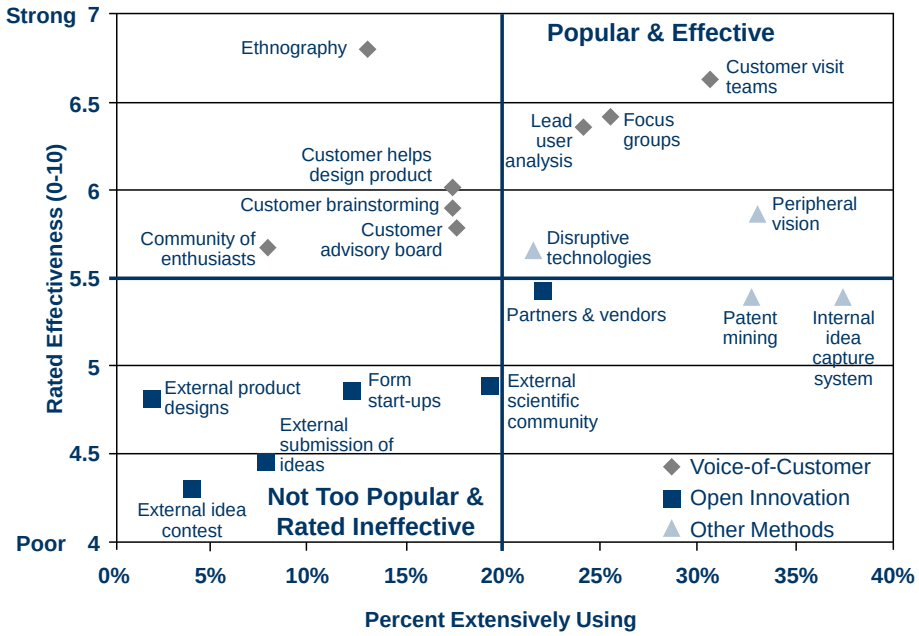

Figure 5-4: The Magic Ideation Quadrant Diagram [COO2008]

The magic ideation quadrant diagram in Figure 5-4 gives a good overview of the popularity and effectiveness of voice-of-customer methods, open innovation approaches and other ideation methods, like peripheral vision, disruptive technologies, patent mapping and internal idea capture (this last method is equal to the corporate suggestion system explained in Chapter 3.1.1). Those in the desirable upper right quadrant are highly recommended to take a close look at. The other approaches in the upper left quadrant are definitely recommended. The other methods found in the lower half of the magic ideation quadrant diagram are lower-rated—this especially applies to the Open Innovation approaches—but have to be considered if the method might fit in the company's special situation, market or industry. So, from a small sub-set of users the Open Innovation methods received positive comments [COO2008].

The special thing about the ideation tool box is that it is not a fixed set of ideation activities. It can be adapted to the company-related specifics. The important aspect is the selection of tools, where the magic ideation quadrant diagram by Cooper and Edgett can be very helpful. The tool selection must also take into account that the techniques have to be easy to be used in practice and employees have to get easily familiar with them.

Fact sheets explaining key issues concerning the individual methods can help deploy such tools in ideation meetings. KSPG already formulated these fact sheets and they can be found in the Appendix of this work. These fact sheets

can be distributed to the participants before an ideation meeting so that they get a basic understanding. Training sessions help exploit the tools' full potential.

Moreover, this tool box has a flexible design, which means that it is desired that it evolves over the time by the inclusion of new effective tools and the elimination of ineffective ones. During the generation of new ideas it is also possible to employ several tools in parallel. These tools can be tied together to a set of activities which help produce ideas.

5.5.3 Guided Ideation

Guided ideation represents a management approach to creativity based performance, which highlights the fact that successful ideation requires an orchestrated interaction between management (control), expertise (analysis) and creativity (insight). The core principle of guided ideation is to drive ideation through organised and engineered idea campaigns [HEM2009].

The following aspects should be part of the guided ideation approach [HEM2009]:

- Develop a management approach to organisational slack, intrinsic motivation and employee engagement from the perspective of ideation performance.
- Designate organisational roles: ideation champion(s), idea campaign manager(s), idea champion(s) and idea reviewer(s).
- Clearly define problems, challenges and desired outcomes.
- Segment and target potential contributors and actively solicit contributions through individual invitations to submit or review ideas from different perspectives.
- Communicate with idea contributors and provide timely feedback and updates.
- Offer real incentives for engagement.
- Conduct internal ideation workshop sessions to increase reach and stimulate contributions.
- Make it easy to submit and share ideas.

The guided ideation can be supported by an external partner, e.g. by a consultant who accompanies the generation of ideas effectively. An example of guided ideation is that a company calls a contest between individual research institutes, which compete against each other for the best idea proposals.

5.5.4 Wild Card Ideation

More often than not, ideas come up very spontaneously, from external idea contributors, or are as immediate reactions to developments from competitors. The challenge for the process is to also integrate these ideas, regardless which stage or gate the ideation process is currently passing through.

If the ideation process is completed and the budget is allocated, then it will take a relatively long time until the next decision during the selection phase, where ideas are admitted and evaluated. Here, valuable time is lost.

Through the wild card function, ideas can be directly submitted to the responsible business unit of the ideation process, e.g. the innovation management. This central department has to have a special budget for the treatment such proposals.

Another case is when ideas are rejected because they just do not fit to the strategic focus, but they have a certain potential for innovation (e.g. for a business model innovation). Here, innovation management can decide consciously for a so-called "submarine project". This kind of project is a research activity which is known of only a very restricted group of people and which bypasses the regular budget [WIL2009].

5.6 The Selection Phase

The ability to pick the right ideas to invest in is a critically important task for almost every company's leadership team in order to maximize productivity from development spending [COO2011]. The final element of the ideation reference process model—the selection phase—meets this challenge. During this phase, the idea communication, idea assessment, and the idea transfer to the subsequent NPD process are the most important steps.

5.6.1 Idea Communication

Already in the year 1955 Peter Drucker stated that "any business enterprise has two – and only these two – basic functions: marketing and innovation. They are the entrepreneurial functions" [DRU1955]. The determining elements of these two basic functions of entrepreneurship are: communication and ideas, because marketing requires communication and innovation needs ideas. This part of the selection phase has to combine these two aspects. Therefore, several aspects have to be considered: from idea marketing to the point of communication culture, both internally and externally.

Zhao [ZHA2005] explored the synergies between entrepreneurship and innovation. She analysed the factors that foster an interaction between the two by the use of the qualitative methods of six case studies of six entrepreneurial and innovative organisations and in-depth interviews with senior managers. Zhao has found that entrepreneurship and innovation are positively related to each other. Both fields are complementary, and a combination of the two is crucial to organisational success and sustainability. The organisational culture and management style are key factors affecting the development of entrepreneurial and innovation behaviour in organisations. An entrepreneur has the skills to embody the ability to search for and identify innovative opportunities and the proactive attitude to promote innovation through a strategic vision [ZHA2005].

A major task of the idea communication phase is the promotion of ideas to increase general awareness. Encouraged through the guided ideation approach (see Chapter 5.5.3), the growing spirit of competition forces them to promote their ideas. This can be achieved by integrating ideas into a (success) story to gain attention, and by highlighting customer value and marketing aspects. Because everyone wants to win the budget, the communication about the ideas becomes more open.

Generally, an open communication and a free flow of information within the company and its external networks are essential to generate ideas and achieve innovative outcomes. Communication facilitates knowledge sharing by combining the wide variety of experiences, opening dialogue, building on others ideas and exploring issues relevant to innovation. Innovative companies reward cross-functional, cross-hierarchical, cross-cultural and cross-technological exchange of information and knowledge [LAW2001]. Openness within the company's organisation encourages people to be creative together [MIL2011].

To accomplish openness, there have to be clear communication paths between the numerous actors within the ideation process across hierarchies, functions and departments, making structures transparent. Part of this is that idea contributors know their first contact person to submit and discuss an idea. Clear rules describing the superior's involvement have to be specified. Defined communication rules and formal mechanisms are also necessary to protect intellectual property and prevent the theft of ideas by third parties in external cooperation.

In this context, every communication path has to be bi-directional, allowing for feedback loops. Once an idea is submitted, idea contributors must get immediate feedback about the further proceeding, and subsequently have to be regularly informed about the current status. Roles and tools supporting the communication have to be defined and introduced: the innovation manager or

the direct superior could be the contact person, and an IT-based solution such as an idea database could be a supporting tool.

Open communication will help increase transparency among employees and towards the company's governance, creating a climate that is favourable for mutual open exchange of creative and innovative thoughts and for better understanding the way decision makers treat them.

5.6.2 Idea Assessment

Building funnels, no tunnels – this has been one of Cooper's major doctrines for decades [COO1999], [COO2011]. It is essential to find a working approach within this ideation process phase that helps assess and prioritise all the created ideas and solutions from the previous idea generation stage.

However, many firms do not use any systematic and analytical evaluation models recommended in literature [BRE2001]. The reasons for the relatively scarce deployment of evaluation models can be seen in a missing fit of the evaluation models to the companies' contingencies. This means that available decision models would need a fundamental adaptation and fine-tuning in order to reflect the characteristics of a particular firm.

The top management has to make the final go or no-go decision, based on an upfront pre-selection carried out by an assessment body, the so-called "steering committee", acting as the interface between the top management and the idea contributors and implementing the open communication culture described in Chapter 5.2.2.

In regular review meetings, this body has to make a strategic screening to identify the best ideas for the subsequent NPD process with respect to the following most important decision points [HAU2011]:

- *Strategic fit:* Does this idea fit in the long-term product and/or market concept?
- *Priority:* Which objective is the most important according to a first estimation?
- *Feasibility:* Based on a first assessment, are the financial and human capacities of the company sufficient enough to start a NPD project based on this idea?
- *Cooperation Decision:* Should the idea be traced in cooperation with an external partner, and if yes, who? Or, if networking already generates it, has this cooperation reached its goals or not?

- *Recruitment Decision:* How to compose the project team working on the innovation in the subsequent NPD process? Who are the team and project leaders?
- *Responsibility System:* Which member of the top management takes over the "sponsorship" for the NPD project?
- *Decision on the organisation of the project:* Which form of organisation is chosen for the project?
- *Release Resources:* Which further resources should be provided for the innovation project?

The assessment of ideas requires the comparison of multiple ideas and their contributions to the NPD process. Portfolio management can help identify the specific position of an idea in a planned NPD project portfolio and its value for the company [MÖH1988]. Cooper recommends implementing a portfolio management in parallel to a stage-gate process [COO1999].

The steering committee has to include a portfolio review during their regular meetings, to review the list of new ideas and assess the portfolio's value. For the review purpose a scoring model is more effective than a financial approach, because financial data is very difficult to estimate in this early phase of innovation. The steering committee has to look for a balance in the portfolio by using visual tools like bubble diagrams [COO1999].

Our expert interviews (see Chapter 5.2.2) support these statements. They confirmed that the importance of a strategic view on ideas and the necessity of a steering committee. They also resulted in a draft of a portfolio bubble diagram showing the strategy fit on the horizontal axis, and the future potential on the vertical axis. The bubbles represent the evaluated ideas and the size of the bubble corresponds to the NPD project costs. In our opinion, this is an interesting recommendation for practical implementation.

Rewarding of selected and declined ideas and their contributors is an essential element of establishing and sustaining the ideation culture. Investigating common and potential rewarding schemes is beyond the scope of this thesis. However, we insist on the fact that the mere recognition of ideation performance by decision makers in the form of review meetings, presentations, discussions, budget allocation, etc. foreseen by our ideation reference process, will already significantly contribute to rewarding. As pointed out by Miller et al. in [MIL2011], the recognition and acknowledgement by the top management is sometimes higher valued by employees than monetary gratifications.

5.6.3 Idea Transfer

Idea transfer is directly linked to idea assessment and idea communication. If a new idea is considered worth passing the money gate, the transfer to the subsequent NPD process has to be assured by clear responsibilities to be defined upfront by the steering committee. Thanks to the fact that our ideation reference process implements success factors derived to a large part from NPD success factors, this transition will be intrinsically smooth. The fundamental basis of success of the NPD process has actually been laid in the upfront ideation process.

5.7 Considerations for Practical Implementation

Top management support is the major lever for the operation of the ideation reference process model. Through a systematic and regular starting point of the idea generation process with top management involvement the foundation of success of the new process is laid. A board meeting under the patronage of the executive board in the beginning of the process will set the course for all the following process steps. Here it is very important that the right decision makers are identified and actively involved. During this first phase of commitment building, the top management has to assure the following deliverables:

- selection of relevant trends,
- building future scenarios,
- definition of relevant needs of action,
- clear structures, roles and responsibilities,
- transparency in every communication,
- shared mental models,
- commitment to sufficient “Freedom of Ideation” for employees,
- idea competitions.

Another major conceptual component towards an efficient ideation process is the personal communication and the continuous flow of information and knowledge, which should be leveraged in interdisciplinary teams, composed of internal and external stakeholders.

Finally, it is important that the implemented new ideation process does not cause much additional work effort to the involved actors to avoid resistance against the new procedure. To this aim, synergetic effects from existing established processes in the company have to be maximised.

Part III:

Implementation of the Ideation Process at KSPG

6 Derivation of the KSPG-specific Ideation Process

6.1 Introduction to the Case Study

In the further course of the thesis we want to discuss the implementation of an ideation process compliant to our proposed reference process model in a corporate environment. Thereby we follow the case study strategy as the adequate research method. Yin states in his book "Case Study Research: Design and Methods" that generally when

1. the research question focus on "how" questions and
2. the researcher has a main interest in a contemporary phenomenon within a real-life context

the case study is the preferred research method [YIN2009].

The case study has been carried out at the German automotive supplier KSPG, which will be introduced in Chapter 6.3. This single-case study can be considered the appropriate design because of the rationale that the researched company represents a typical case among other companies in the same industry [YIN2009]. It helps us validate and adjust our reference process model.

The case study starts with a general description of the particular context of innovation management in automotive industry followed by an extensive as-is analysis of the current situation at KSPG. For this purpose, a corporate situation analysis based on the evaluation of corporate documents was done. Selected basic findings have already been published [NEU2011c].

In addition to the collection of secondary data, internal experts, mainly managers from the department Research and Technology, have been interviewed. These interviews basically followed the guideline for the external expert interviews, albeit in a more informal and regular fashion in order to guarantee the successful implementation of the process.

6.2 Description of the Current Situation in the Automotive Industry

6.2.1 Framework and Basic Conditions

Within the R&D- and innovation-driven environment of the automotive industry the capacity of innovation and the performance of activities have become major stakes for the success of companies. However, being innovative is not the universal remedy for all existing economic problems of companies in the automotive sector, proved by high flop rates of innovations [BRO1999]. For example, only 20% of the R&D spending by both OEMs and automotive suppliers represents profitable innovation investment [DAN2007].

In the last couple of years, the automotive industry has witnessed high levels of strategic business activities undertaken by players worldwide, driven largely by a tough operating environment that featured flat or declining demand trends, rapid consolidation, rising raw material costs and severe pricing pressures. Especially during the economic crisis with a significant slump in demand and gyrating fuel prices, original equipment manufacturers (OEMs) have become aware of the need for fundamentally rethinking the way they do business, both with end-customers and suppliers. Resources are limited, costs must be contained, and yet customers still desire new, cutting-edge products.

OEMs have also identified product innovation as a key long-term measure to enhance their market shares [ILI2009]. To this end, advanced technology and product development initiatives are becoming critical issues on which all automakers are focusing [ILI2009]. Subsequently, automakers have increased their focus on R&D considerably over the years, which has enabled them to develop cutting-edge products and technologies that ultimately satisfy the needs of the end-user.

As a complementary development, the increasing focus on innovation has also led to the shifting of product development responsibilities from the OEM level to the component supplier level to achieve cost efficiency [DAN2007] and [DAN2008b]. Since OEMs are under immense pressure to differentiate their products through innovation, some of the top component suppliers have been forced to take up engineering, designing, R&D and assembling responsibilities that were previously the functions of OEMs [KUR2004]. Suppliers are therefore also under pressure to strengthen their R&D investments in order to develop breakthrough products and technologies, which would complement the investments being made by OEMs in the R&D field [KUR2004]. To better understand the requirements of OEMs, suppliers are working closely with the latter in areas such as product design and development, manufacturing and

material selection, which are supported by computerised modelling and product design software tools.

Instead of assembling individual components sourced from numerous suppliers, OEMs worldwide now find it sensible to delegate the sourcing responsibility to a few select suppliers that can provide them with fully designed systems, modules and pre-assembled parts [MAT2004]. Thanks to rapidly evolving consumer preferences and shortened product life-cycles, vendor consolidations have emerged as the inevitable option, resulting in the global automotive components industry experiencing several structural changes over the past few years. The North American and Western European players no longer dominate the component industry, as Asian and Eastern European players gain increasing market share [GER2012a]. The latter provide superior technical expertise as well as economies of scale, which helps the OEMs stay afloat in the fiercely competitive market [KUR2004].

In the product development arena, electronics and information technology, quality requirements, passenger safety, passenger comfort and compliance with environmental regulations-related aspects have emerged as the prime areas of focus. Among these, automotive electronics and mechatronical products, which integrate mechanical, electronical and software components, have been identified as the fastest-growing field and one with enormous growth potential [GER2012b] and [STA2011a].

Due to the increasing ratio of software development in automotive vehicles (more than 85% of the functionality in the modern motor vehicle are now controlled by software), both the motor vehicle manufacturer and the supplier need to take action to address these issues [SPI2012]. In 2003 the SOQRATES [SOQ2012] initiative was set up supported by the Bavarian Software Offensive and ISQI to launch Automotive SPICE® [SPI2012] in the German automotive industry [MES2010a], [MES2010b]. Starting with 16 companies in the first year, now approximately 24 leading German and Austrian companies act in the Automotive SPICE® initiative. Automotive SPICE® is based on ISO 15504 and focuses on software capability assessments to provide significant business benefits in use, but at the same time expose the scale of the potential problems, particularly with suppliers of safety-critical embedded software system components [SPI2012].

The Automotive SPICE® initiative developed a common framework for the assessment of suppliers in the automotive industry [SPI2012]. The result is the publication of the Automotive SPICE® Process Assessment Model together with the associated Process Reference Model, which is used in major automotive firms worldwide nowadays [MES2010b]. Automotive SPICE® represents a major topic of today's business and also an increasingly important objective for future developments of the automotive sector.

Environmental regulations are doing their part in driving the automotive industry to innovate and develop new products and technologies. OEMs are continuously urging component suppliers to develop products that comply with environmental regulations worldwide, as well as products that are eco-friendly. Increasing levels of vehicular emissions and stringent environmental regulations have led to the development of several products such as catalytic converters, exhaust gas recirculation (EGR) systems and air injection reactors, among others. The emergence of emissions standards for all vehicles (such as the European emissions standards) has resulted in innovations like hydrogen-fuelled cars, electric vehicles and hybrid electric vehicles [GER2012b].

As a prominent trend, suppliers are busy forging strategic partnerships with other companies and research agencies to come up with innovative products. Suppliers are also working towards creating common platforms, through which various business units in a company can share knowledge and technologies by integrating various operations. This helps companies to speed up product development, reduce costs and thereby deliver better value to customers [STO2004].

In 2015, the global automotive suppliers and engineering firms will invest approximately EUR 65 billion in R&D. This sum is far more than twice as much as the OEMs' budgets [DAN2008b]. Therefore automotive suppliers will generate most of the engineering jobs in future – globally a total of about 250.000 jobs until 2015 [DAN2008b].

However, some of the major concerns with respect to product development include adequate intellectual property protections, timely availability of funds, delays in acceptance of new technologies and products and the rapidly shortening product/technology life cycles that quickly render such new products and technologies obsolete.

6.2.2 Innovation Management Trends and Requirements

The automotive industry is one of the most highly innovation-driven industries [BIR2003]. This fact applies especially for the German automotive industry. With a total of EUR 15,8 billion, the R&D expenditure undertaken by the German automotive industry accounted for more than one-third of the total R&D expenditure of the German industry in 2011 [GER2012b]. In order to enhance its innovative power, the German automotive industry has stepped up its research efforts continuously in the course of the past few years. For example, the German automotive industry filed 10 patents per diem in 2010, placing itself at the forefront of patent statistics [GER2011].

Innovation management in automotive sector (as well as in other technology-driven sectors) is still very much focused on the generation, assessment, and

patenting of ideas for technical solutions to known problems. The number of patents filed per year is thus typically used to assess a company's innovation power. However, as pointed out in Chapter 2.1, this indicator completely fails to take into account the success of the implementation of those patents and ideas on the market in terms of key factors of time (design, implementation, market launch, lifetime, etc.), cost (development, production, total cost of ownership, etc.), environmental impact (ecology, economy, society), and numerous others.

Besides creating networked operational processes for the product development, the actors in the automotive market are also shifting towards new forms of innovation management [ILI2010b]. The systematic involvement of numerous stakeholders of the product life cycle in the innovation management system has huge potential [NEU2011d]. Ili et al. illustrate in their study that Open Innovation is already appropriate for the automotive industry, and that it will be a crucial factor in the next 10 years [ILI2010a]. For example, Johnson Controls has recently launched a web-based solution for Open Innovation [JOH2012], illustrated in Figure 6-1:

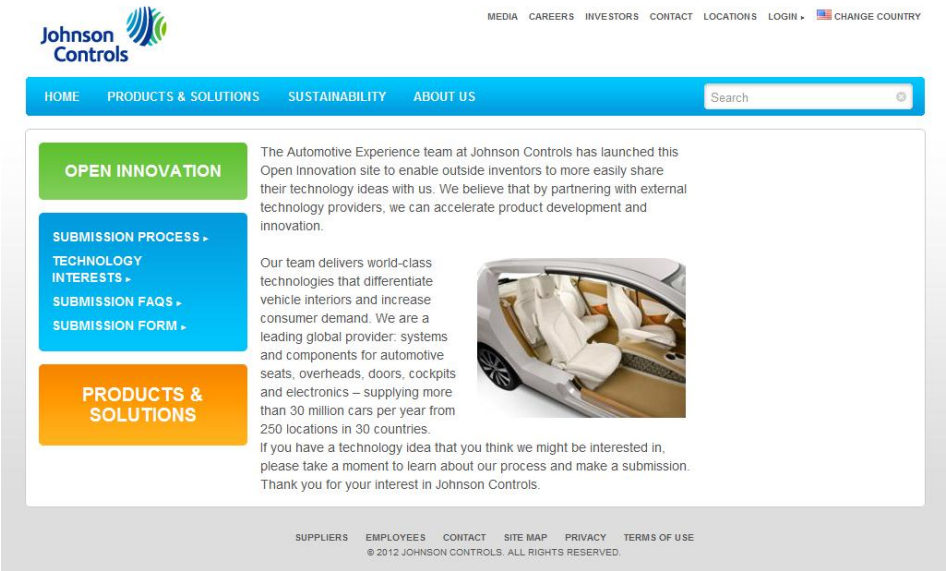

Figure 6-1: Open Innovation at Johnson Controls [JOH2012]

Via internet everyone is invited to submit technology ideas which are covered by an existing patent or have a pending patent application. The Automotive Experience team at Johnson Controls reviews these ideas. This review process can take up to 3 months, and after the completion of this procedure, Johnson Controls will provide the idea contributor with a status on his submission

[JOH2012]. All in all, the process focuses on patents and seems very strict and not very transparent.

However, one of the major concerns with respect to innovation management is still the adequate organisation of the fuzzy front-end of innovations, especially the development of a proper idea generation process [NEU2011a]. For automotive suppliers this trend implies that increasingly they are supposed to predict and influence trends and innovations themselves, rather than being driven by OEMs.

The European car industry is highly dynamic and innovative. Its R&D expenditures are well above average in Europe's manufacturing sector. Among the most important drivers of innovation are consumer demand (for comfort, safety and fuel economy), international competition, and environmental objectives and regulations.

Although the gains are very difficult to be quantified and generalised, the move towards stakeholder-integration based innovation management processes and organisations has become a must also for automotive suppliers. The automotive industry, however, with its enormous development costs, lengthy product cycles and fierce global competition, is a traditionally much closed industry, with only very limited sharing of information and technology.

It is all the more important that innovation management in the field of automotive industry must cope with the increasingly complex market conditions. Due to its comprehensive and profound interactions with other corporate divisions and the business environment the innovation management has to be open for new models of creating and profiting from innovation [ILI2010a], to find ways to ensure the generation of new ideas for radical product innovations.

Especially knowledge plays a major role in today's innovation management in the automotive supplier sector. An empirical study by Barachini and Rankl [BAR2008] leads to the assumption that knowledge management and innovation management is important for the whole automotive supplier industry. They discovered a strong positive correlation between knowledge management and innovation, and recommend that knowledge and innovation management should be regarded as key investments in the long run.

The automotive supplier industry prepares more and more the way for new automotive technologies worldwide. Because of the automotive suppliers' high involvement and responsibility during the development activities of the OEMs, most of the vehicle parts are engineered and manufactured by the suppliers [DAN2008b] and [DAN2007]. The classical approach, to buy parts and components from a variety of suppliers, will be increasingly replaced by purchasing more complex, mostly pre-assembled systems (e.g. front-end

systems) from only a few suppliers (so-called single sourcing). Against the background of globalisation and because of the ever-growing requirements of the OEMs—like e.g. shorter development times and life cycles of the models or the increasing relevance of electronics in vehicles—a further reinforced consolidation process within the supplier industry will take place [MAT2004].

In the long run, it has to be assumed that almost the complete vehicle comes from the plants of some few system suppliers and/or mega-suppliers, and the branding OEMs assume only the overall project responsibility and coordination. These relationships result in an interdependent manufacturer-supplier-network [MAT2004] and [STA2011b]. Consequently, due to the fact that the trend is moving away from components towards complex and self-consistent systems, new supply chains of strategic partners are coming up (Figure 6-2) [KUR2004].

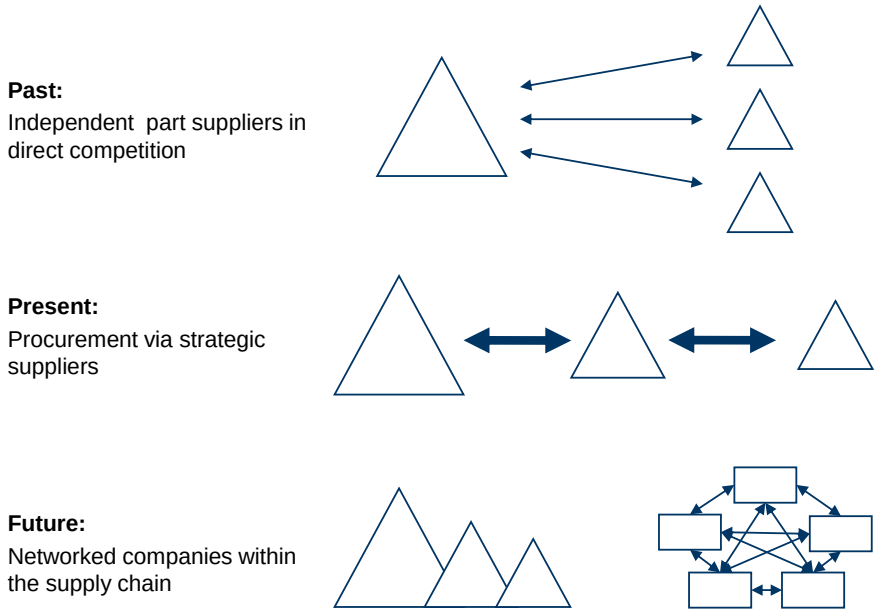

Figure 6-2: Changing Supply Chains in Automotive Supplier Industry [KUR2004]

Because the huge range of activities concerned with the development of system solutions cannot be handled by only one supplier, a network of interconnected supplier companies will act under the leadership of one global system integrator [MAT2004]. This evolution from independent component suppliers in the past towards defined and networked supply chains of system suppliers encourages the creation of integrated teams. The intensity of interdependencies depends on the fitting core competencies and product life cycle know-how of the partners [KUR2004].

These future trends lead to the assumptions that

- the technology leadership in the automotive industry shifts more and more to the suppliers [STO2004];
- the changing structures in the supply chain require automotive suppliers to enlarge their knowledge about relationships with their organisational partners;
- suppliers need to build up system competence, as they are assuming responsibility for self-consistent system and subsystems rather than individual parts and components;
- as system providers, suppliers have to master the complete life cycle of the systems they are developing.

These four factors demand from both automotive OEMs and suppliers innovations on an organisational level. Current organisations do not support the integration of experts over numerous different domains and hierarchical levels. Luckily, however, there are some examples of modern organisations which are completely focused on innovation by integration, and which confirm their expected huge potential in terms of innovation power. Renault's Techno-centre in Guyancourt [BON1998] is one of the most outstanding stereotype examples of its kind in the automotive sector.

The outsourcing of innovation activities to automotive suppliers has the consequence that suppliers file independent patents in order to keep their own innovations exclusive. Thus the large automotive suppliers focus their research on the same areas as the OEMs, particularly to gain new knowledge and strategically strong patents. Only very innovative suppliers succeed in the development and maintenance of their patent portfolio to strengthen their negotiation position versus the OEMs [GAS2007].

To understand innovation management in the automotive industry and based on the findings from their study [DAN2007], the management consultancy Oliver Wyman Automotive defined a system called "Innovation Strategy Framework" (ISF) which takes the following success factors of innovation management into account: a clear innovation strategy that is closely connected to the company's overall business model, the right team that has the culture to put the strategy to work, an organisation that can effectively and efficiently steer the necessary innovation process and an intelligent business case that enables innovations to be turned into tangible profit. The ISF consists of four elements:

- Innovation proposition: description of the major benefit and target segment of the innovation and also the primary innovation guideline of the company.

- Organisation and culture: explanations of the innovation process, R&D capacities and facilities structure.
- Competence focus and collaboration: composition and evaluation of the internal and external competencies and collaborations.
- Business case: definition of the underlying revenue model for the innovation and the protection of the innovation against exploitation from competitors.

By using the ISF six innovator archetypes have been identified for OEMs and six for suppliers. Each describes a typical ISF profile in which the different elements fit together to form a coherent system. Many companies follow two or more innovation strategies at the same time – suppliers with different product ranges and OEMs with different brands. In addition, innovation archetypes are not static role models, but evolve with time [DAN2007]. Table 6-1 shows conclusively the archetypes of innovation management for automotive suppliers.

Innovation archetype	Innovation proposition	Focus and collaboration	Business case
Radical innovator	• Replaces old systems or establishes new ones	• Specialized focus • Keeps know-how in-house	• Price premium • Strong IP protection
Functional enricher	• Brings new functions to the market • OEM and end customer focus	• Functional integration focus • Keeps know-how in-house	• Price premium • Strong IP protection
System connector	• Functional process or product optimisation • End customer focus	• Expansion into new systems via coop networks • Open interfaces	• Price premium or low-cost • Fairly weak IP protection
Process champion	• Incremental process innovation to serve broader markets • Adapts to customers	• Process focus • Open to coops	• Low costs in mature techs • Weak IP protection
Niche performer	• Product or process innovator serving niche markets • End customer focus	• Very specialized know-how • Selective coops	• Price premium • Varying IP protection
Module shaper	• Focus on module design and processes • Defines modules anew	• Unique know-how combination • Coop with OEM/system connector	• Value capture from OEM • Cost reduction for modules

Table 6-1: Archetypes of Innovation Management for Automotive Suppliers [DAN2007]

The new forms of e-commerce in the B2B sector and the extended EDI standards (Electronic Data Interchange)—made possible by internet technology—expedite the re-orientation of the value-added chain, which has been ongoing since the mid-1990s. The use of e-commerce is pushed by the automotive manufacturers in order to obtain savings in time during the product development and implementation of the contract as well as gain further cost reductions. In recent times, so-called B2B platforms were established. These B2B-platforms offer to several companies virtual market places where the relations to suppliers can be managed on-line [MAT2004].

By consistent realisation, both automotive manufacturers and suppliers can benefit from system procurement: manufacturers profit from high-quality and innovative products to lower costs, suppliers profit by increased order quantities, more stable business relationships as well as higher competitiveness. However, the mutual dependency between automotive manufacturers and their suppliers has also grown. Meanwhile, this degree of dependency achieved a historical value with manufacturing depths of only 30-35% [MAT2004].

6.3 Description of the Current Situation at KSPG

6.3.1 Corporate Organisation

KSPG is the parent company of Rheinmetall's automotive sector. As a global tier-one supplier to the automotive industry and because of its vast capabilities, KSPG assumes leading positions in the product and component segments air supply, emission control and pumps and in the development, manufacture and aftermarket supply of pistons, engine blocks and plain bearings [KSP2012a].

In April 2012, the KSPG Group restructured its business into the following three divisions [KSP2012b]:

- *Hardparts:* Pistons, Aluminum-Technology, Plain Bearings and Large-Bore Pistons.
- *Mechatronics:* Pierburg and Pierburg Pump Technology.
- *Motorservice:* Motor Service International and Motor Service Domestic (incl. BF Germany).

Figure 6-3 presents KSPG's divisional structure, which allows achieving an interdivisional optimisation of processes as well as an even closer strategic focus within the business units [KSP2012b].

With its systems and modules, KSPG generated sales of around EUR 2.313 million in 2011. At its production locations in Europe, North and South America plus China, the group employs a workforce of around 11.548 employees [RHE2012].

The Mechatronic division comprises the two companies Pierburg GmbH and Pierburg Pump Technology GmbH, which are both headquartered in Neuss, Germany. Pierburg offers nowadays emission systems, commercial diesel systems, actuators and solenoid valves. In 2008, Pierburg Pump Technology GmbH (PPT) was founded as a specialist in innovative and advanced pumps technology. Their product portfolio ranges from coolant pumps, oil pumps and water recirculation pumps to vacuum pumps [KSP2012a].

Figure 6-3: Divisional Structure of KSPG Automotive Group

The Hardparts division includes the companies KS Kolbenschmidt, KS Aluminium-Technologie both located in Neckarsulm, Germany, and KS Gleitlager in St. Leon-Rot, Germany. The current product range of this Hardparts division comprises pistons, cylinder blocks and finish-machining, engine plain bearings and Permaglide®, and large-bore pistons [KSP2012a].

As world-wide successful automotive supplier with outstanding expertise in the fields of automotive components all around the engine and its role as tier-one supplier, KSPG takes top positions on the respective markets and has traditionally been one of the closest partners to the automotive industry. The production development takes place in close co-operation with renowned car manufacturers. Eco-friendly automotive technology for reducing emissions and

efficient fuel consumption, downsizing, reliability, quality and safety are the main factors driving the innovations of KSPG [KSP2012a].

6.3.2 Central Department Research and Technology

In 2010, the department Research and Technology was founded combining the Advanced Engineering, the Central Engineering and New Propulsion Technologies in one central corporate unit of the whole KSPG Group. In 2011, KSPG spent EUR 130 million for Research and Development. This corresponds approximately to 5,6% of the company's total sales [RHE2012].

In August 2012, this organisation of the central department Research and Technology was restructured, according to the new division structure of the KSPG group. One major change is that parts of the Advanced Engineering are now tied to the respective divisions of the KSPG Group. Figure 6-4 shows the current organisation of KSPG Research and Technology.

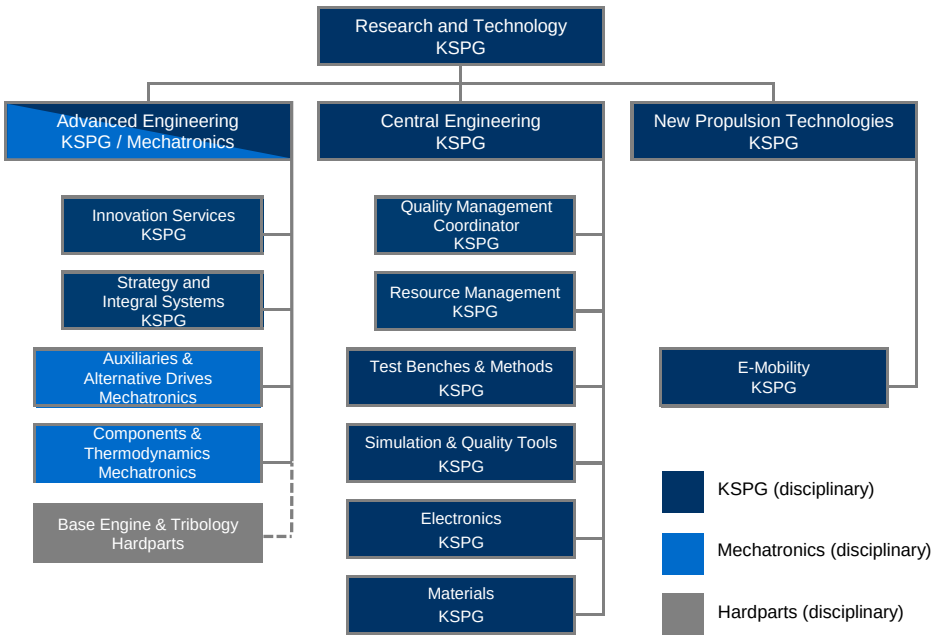

Figure 6-4: Organisation KSPG Central Department Research and Technology from August 2012

The current Innovation Services as part of the Advanced Engineering department work mainly for the KSPG division Mechatronics. In line with strategic considerations, innovation management is still a comprehensive corporate task. However, innovation services have a minor practical priority for

the division Hardparts than for Mechatronics. At Pierburg and Pierburg Pump Technology, most of the experiences underlying this research work were made.

6.3.3 Existing Innovation Management at KSPG

The current innovation management process at KSPG is part of the KSPG Advanced Development Process (ADP). The ADP and the division-specific Product Development Processes (PDP) are clearly defined and well-established stage-gate processes. The tools used by the innovation management and the ADP are also very well defined and practically proved and applied. The innovation management has been streamed up to the ADP and is responsible for the collection, selection, and ranking of product ideas to feed the Advanced Engineering department with new promising ideas [NEU2010], [NEU2011b].

This established innovation process at KSPG follows the innovation value chain paradigm defined by Hansen and Bikinshaw [HAN2007] and explained in Chapter 2.2.3. According to this model, the internal and external spread of product ideas that have actually led to products is well handled through the ADP and the PDP. Also the development of new products is very well organised in the ADP. The selection method of ideas, up to now the main task of innovation management at KSPG, is also rather satisfying, however a certain improvement potential is expected and demanded by the top management [NEU2011c]. The principal need for improvement, however, lies in idea generation. Figure 6-5 shows this analysis against the background of the innovation value chain.

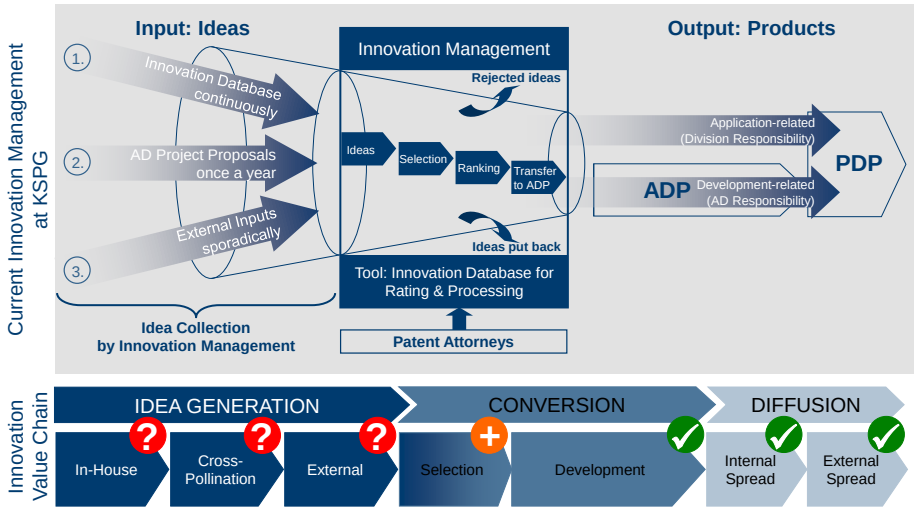

Figure 6-5: Current Innovation management at KSPG according to the Innovation Value Chain [NEU2012]

The existing innovation management at KSPG mainly collects ideas. For this purpose the innovation management uses three different types of tools or sources. The main tool is the KSPG Innovation Database, which allows collecting ideas continuously during the year. The second tool is a call for ideas for advanced development projects once a year. This request is made by email by the head of the Advanced Engineering department and addresses the top management of the different divisions and business units of the KSPG group. The third source is mainly the result of ad-hoc activities. Sporadically, external ideas can be identified as possibly interesting for KSPG and will then be analysed more deeply regarding their implementation at KSPG.

A specialty of the innovation management at the Mechatronics division of KSPG is the Innovation Database as a central tool. It supports the innovation management in the collection, evaluation and selection of inventions and technical product ideas. This database was introduced by the former Advanced Engineering department of Pierburg in 2006. During the year 2007, the Innovation Database was substantially revised and rolled out anew. Since 2008, there exists also a German-language version for Pierburg and an English-language version for the PPT, which can also be operated by employees in foreign locations.

In 2011, the configuration of the Innovation Database was completely updated and improved, especially regarding performance and usability. This rework included e.g. the optimisation of workflows through intelligent automation and the storage of ADP project proposals, so that all three kinds of ideas shown in Figure 6-5 are centrally collected in the Innovation Database. Since its rollout in 2007, approximately over 500 inventions and technical product ideas, as well as more than 100 ADP proposals have been collected there. In addition, the Innovation Database is part of the corporate suggestion system as the medium where ideas for internal process improvements are handled. This has the big advantage that employees can use one and the same tool and easy-to-use interface to communicate any type of idea.

The Innovation Database is available via intranet to all Pierburg and PPT employees. The ideas and inventions stored in the Innovation Database are secured and protected against the external access. The standardised process cycle of the Innovation Database ensures a simplification and a shortening of the operational workflow. Furthermore, all ideas and inventions in the Innovation Database are stored in the idea pool, which ensures that ideas that are not considered relevant at a certain point of time will not get lost. The fact that all ideas and inventions are visible by all users of the database helps to create transparency and to stimulate further ideas.

The workflow facilitated by the Innovation Database (Figure 6-6) can be described as follows: idea contributors enter their ideas and classify them as

invention or technical product idea. The technical aspect of the innovation is important and represents a first stop criterion. Subsequently, the innovation manager makes a pre-selection in coordination with the patent attorney for application-related ideas, and additionally with the Advanced Engineering department in the case of development-related ideas. At Mechatronics, the attribute "development-related" describes an idea or invention that has the potential for a radical innovation, whereas "application-related" is used in the case of a technical detail improvement of an existing product, which leads primarily to an incremental innovation and is relevant for the PDP rather than the ADP (see Figure 6-5).

In case of inventions a further pre-selection by patent attorneys filters innovations without success potential at an early stage. Ideas passing the pre-selection successfully will be assessed by a team of nominated experts. The evaluation criteria of the experts are: technology, patents and strategy, substitution, customer needs and product life cycle, market, sales, investment and budget, start of production, and resources. A ranking of the ideas and inventions is done on the basis of the experts' evaluations in cooperation with the Advanced Engineering department. The next two steps "Preliminary decision" and "Decision-making" terminate the process and describe the transfer of the idea to the different development departments.

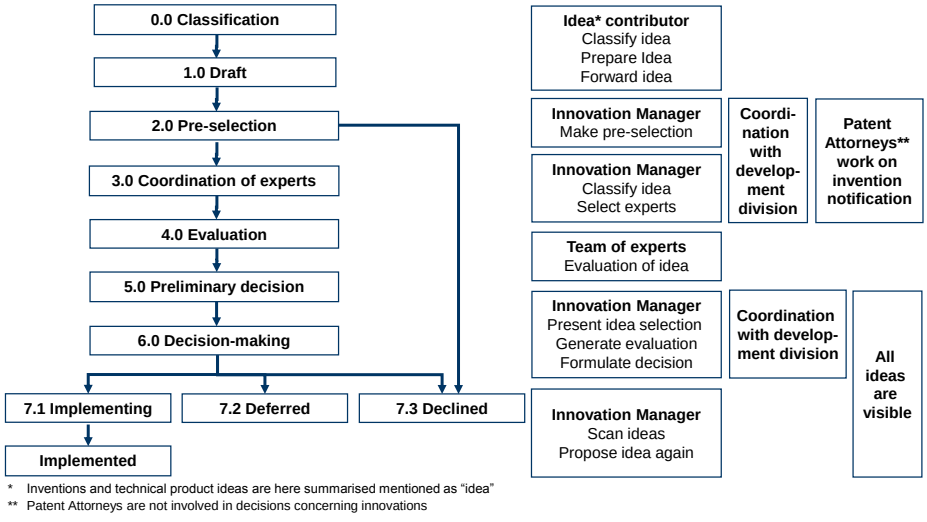

Figure 6-6: The Process Cycle of the Innovation Database [NEU2011c]

This existing process for managing ideas at KSPG is explained in detail in the corporate process model and has already been audited internally and externally according to ISO/TS 16949:2009 [IAT2009].

Although the current innovation management process is well accepted by employees and superiors, practical experiences made during the last years reveal that the mere passive collection of ideas is not sufficient to find innovative ideas for the ADP. The very beginning of innovation is—apart from the well-known three idea sources in Figure 6-5—very fuzzy, and the top management of Advanced Engineering was convinced that the idea potential was far from being exploited.

Therefore, the demand for an active idea generation and the need to improve today's innovation management process toward a structured and output-oriented ideation process moved into the focus of KSPG's Advanced Engineering department. Against this background, the management has defined the challenges of the new ideation process at KSPG as follows:

- The fuzzy front-end of the innovation process has to be clearer.
- Ideation has to run in a structured way to guarantee a continuous flow of ideas.
- Innovation management has to get an important directing role in the active generation of ideas.
- An innovative organisational culture that motivates employees and supports the generation of ideas has to be developed.
- The ideation process shall be systematic so as to provide an important means of decision support.

6.4 Target Description of the Case Study

The global objective the case study is to validate our ideation reference process model in the corporate context of the automotive supplier KSPG by the introduction of a company-specific ideation process. The analysis of the existing innovation management system at KSPG presented in Chapter 6.3.3, and the challenges defined by the top management legitimate the relevance of our activity.

We defined our main goals for this study as follows:

- to derive a KSPG-specific ideation process from our ideation reference process model, and
- to initiate the deployment of this new process in the corporate environment together with the top management so as to have an initial validation of our results.

The application of the ideation process has to consider that the latter will be associated with the ADP at KSPG. However, by its very nature, the new ideation process has to lead to changes in the innovation organisation and culture, which makes the introduction of the process at KSPG a long-term initiative which goes far beyond the mere enlargement of the ADP.

6.5 Steps Towards the Process Derivation

6.5.1 Overview

In order to derive a KSPG-specific ideation process, our approach will follow six major steps:

1. Identification of the priority areas of action based on the analysis of the achievement levels of each key success factor of ideation in the currently existing innovation process in the company.
2. Determination of the organisational elements in the company, which are necessary to achieve each stage and gate of the ideation reference process model.
3. Design of a company-specific adaptation of the ideation reference process model, which takes into account the implementation of

   (a) all the key success factors of ideation, as well as

   (b) all the priority areas of action identified in step 1

   according to the organisational elements determined in step 2.
4. Demonstration of the feasibility of the new company-specific ideation process.
5. Proposition of a concept for the introduction of the new ideation process in accordance with the existing organisation.
6. Accompaniment of the introduction and continuous improvement of the ideation reference process model and the company-specific ideation process based on gained experience and acquired know-how.

Our case study project started in March 2012, and we have – until the day of the final editing of this manuscript – already passed all steps from 1 to 5 with great satisfaction of the top management. The start of the last step number 6 is scheduled for late autumn 2012.

6.5.2 Step 1: Identification of Priority Areas of Action

For the identification of the priority areas of action a deeper as-is analysis of the existing innovation process at KSPG is necessary. The major focus of this analysis is to discover how each of the key success factors of ideation is achieved at KSPG.

One of the first findings is that the Innovation Database and the organisation of inventions and patent applications mainly dominate the innovation management at KSPG Mechatronics. A critical analysis of the existing innovation management system at Mechatronics reveals that currently the idea generation is limited to a core group of approximately 5% of Mechatronics' employees acting as idea contributors. Although the tool is available to nearly 4.000 employees in all departments (like R&D, Sales, Purchasing, etc.), including management and executives, and also in plants outside Germany in English language in the case of PPT, input from not R&D-related departments and from employees in leading positions outside the R&D department is very low. Relying only on ideas and information from these well-known sources within the company induces a threat of stagnation, and endangers the sustainability of the company's innovation process [NEU2011b].

The yearly call for ideas for advanced development projects is a very good approach by the head of the Advanced Engineering department to involve more actors into the idea generation. However, it causes a very large administrative work effort at the end of each year where the planning of the resources for the upcoming ADP projects has to be closed. Moreover, it fails to support the generation of ideas pro-actively.

The deeper problem of the whole innovation management is that it started its work with the development of a tool, the Innovation Database. This focus on the tool happened without a transparent overall organisational direction towards innovation. No clearly communicated innovation strategy from top management exists until now.

In July 2012 a strategic project to define a product and innovation strategy for KSPG Mechatronics has been launched. In this project, the Advanced Engineering department is heavily involved, and the head of this department has the project lead. First results, in particular the identification of innovation fields, are expected for the end of 2012.

For the final evaluation of the achievement levels of each key success factor of ideation in the currently existing innovation process, we surveyed corporate documents and—this was a very important and valuable information source—we had several talks with internal experts of KSPG. As a final result of our analysis the following KSPG-specific fields of action can be formulated:

- Action No. 1 (A1): *Quantity and Quality!*

  KSPG has to generate high-quality and high-quantity ideas to ensure innovation and competitiveness.

- Action No. 2 (A2): *Commitment and Focus!*

  Call for ideation requires a visible order from the management board and a clear focus on previously defined and communicated fields of innovation.

- Action No. 3 (A3): *Connectivity and Effectiveness!*

  The generation and selection of ideas at KSPG do not happen in networks which result in lost innovation potential.

- Action No. 4 (A4): *Creativity and Freedom!*

  Methodical creativity and freedom for the generation of ideas are not integrated in the process-oriented corporate culture of KSPG.

- Action No. 5 (A5): *Competition and Dynamic!*

  Current ideation is not connected with a successful competition of the business units for the advanced development budget.

6.5.3 Step 2: Determination of Organisational Elements

In the second step we analysed intensely the organisational framework at KSPG to determine elements which facilitate or—on the contrary—inhibit to implement the stages and gates of the ideation reference process model. One important goal is to motivate the organisation at KSPG for the integration of external and internal stakeholders to leverage ideation, like presented in Chapter 5.5.1.

Thus, the existing product ideas from KSPG Mechatronics were explored to identify their origins. A quantitative survey of 437 ideas from Pierburg and PPT which have led to patents and product innovations revealed that most of the ideas came up through the idea contributors' own considerations. Figure 6-7 summarises the results of the analysis.

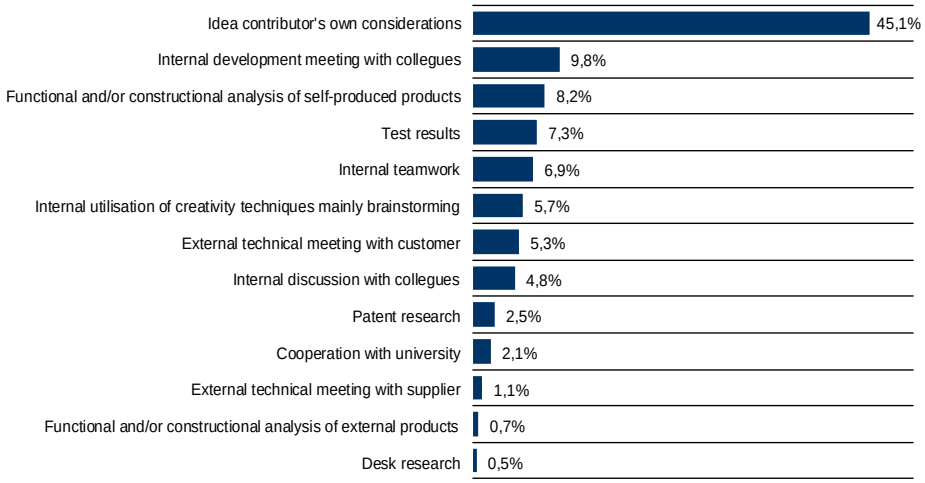

Figure 6-7: Origins of ideas (n=437 patent applications at Pierburg and PPT) [NEU2012]

Another main origin of ideas is the internal exchange with colleagues, either during internal development meetings, teamwork, internal brainstorming sessions or discussions. Tests of existing self-produced or external products and the analysis of current market requirements and future trends helped to generate ideas in 19,2% of the cases.

Very important for the implementation of a stakeholder integrated ideation process in the existing system is the fact that only 8,5% of the ideas occur through the involvement of external stakeholders. The most influential external stakeholders are the customers, universities and suppliers.

This analysis shows that several organisational measures will have to be adopted in order to capitalise on a more open innovation system and to exploit its potential. To capture new ideas from different sources, it is essential to identify potential sources and specific methods to extract and format their data. Also it is has to be analysed how this information will be collected and in which time frame. Depending on the nature of the idea sources diverse methods and techniques to extract, store and select the ideas have to be chosen individually.

On the one hand, ideas can be collected within the company from employees and management. For this purpose several methods already exist at KSPG as described in Chapter 6.3.3. On the other hand, information from external stakeholders must be observed and explored for usable ideas. Both these steps represent a strategic move towards the adoption of Open Innovation [CHE2003] principles.

The definition of internal stakeholders in Chapter 5.5.1 is the basis for our analysis where in-house idea generation activities at KSPG have to be addressed. Typically, only R&D employees submit ideas. Therefore, an organisational framework to manage idea generation involving all internal stakeholders at KSPG is essential. Table 6-2 summarises the identified direct and indirect ways to generate ideas from these internal sources.

Stakeholder	Idea Sources	Direct ways to get ideas	Indirect ways to get ideas
Executive	Executive in the company	• Idea generation activities and ideation process • Innovation Database	• General overview of external stakeholders interests
Management	Management professional in the company	• Same as first source	• Same as first source
Expert Departments	Departments includes R&D, sales, purchasing, quality, manufacturing	• Same as first source Additionally: • Contractual agreements • Direct talks	• Especially sales should capture customer ideas • Purchasing should collect supplier ideas
After-Sales	Employees from the KSPG division Motorservice promote and sell products directly to end-users	• Same as first source Additionally: • Contractual agreements • Direct talks	• Organisation of workshops or seminars at the independent workshops to present and discuss new product solutions directly with the end-users
Cross-functional Teams	A interdepartmental group dedicated to coming up with new ideas, research and knowledge	• Outcome based ideas • Inventor circles	• This group can have members from all departments and so different aspects can be considered
External Employees	Collective term for loosely affiliated employees, like project-based employees, temporary employees, freelancers or students	• Same as first source	• Stimulus from outside • Possible solution to avoid to be professionally blinkered
Administration	Departments includes HR, Legal Affairs, Logistics, Controlling, Finance, Accounting, IT	• Same as first source	• Legal Affairs may support with information about legislation • Controlling identifies cost savings related to product design

Table 6-2: Overview of Internal Idea Sources at KSPG

Providing a tool like the Innovation Database to support idea collection tool is important, but not sufficient. Innovation management also has to create an environment for the promotion of ideas. Ideation is a topic of every employee. Thus, innovation management has to motivate all employees to take part in the ideation activities, and in particular give the impulses for ideas in particular by forming dedicated cross-functional ideation teams.

A first effective measure in this direction is the creation of regular internal KSPG Ideation Meetings [NEU2012]. The periodicity for these meetings and reporting to the top management should be adjusted to the major objectives of the meetings:

- The wider the ideation topic, and the earlier the status of the ideation process, the longer the meeting intervals can be.
- The more concrete the discussed ideas are, the more often the ideation team should meet, and the more intensively their work should be targeted at making the idea(s) more mature (idea maturation process).

The already existing Innovation Database can support these meetings effectively as a reporting tool. Forms should be available for all the criteria the strategic decision committee needs.

Also the role of the team moderator (leader) is vital for leading the team discussions into the right direction from the very beginning (starting with a summary of the results already achieved in previous meetings).

New ideas coming up during such meetings (even if they are not directly related to the focus idea under discussion) have to be kept track of, and communicated after the meeting.

Forming these KSPG ideation meetings will be the first main step to achieve a reliable idea generation process at KSPG AG.

As shown in Chapter 5.5.1, our analysis of external sources of ideas will concentrate on following six main sources: customers, competitors, science, society, government and suppliers. Within KSPG a lot of activities and techniques exist which are directly connected with idea sources and the generation of product ideas. Other actions concern indirect idea sources and influence only indirectly the generation of product ideas. These information sources, which help mainly management and business development up to now, have to be analysed for how they can also be used for a successful ideation. Table 6-3 shows the major existing external idea sources from KSPG's point of view.

Stakeholder	Idea Sources	Direct ways to get ideas	Indirect ways to get ideas
Customers	• Core customer groups	• Customer submitted ideas • Interviews • Customer contracts negotiations	• Customer analysis • Satisfaction surveys • Customer database • Internal customer-related teams
Competitors	• Direct competitors	• Competitive Intelligence • Direct talks during international fairs and summits	• Market research firms
Science	• Universities	• Sponsoring of university chairs • Master thesis projects • Networking	• Scanning new technology releases, like PhD thesis or other publications
Society	• Groups of interests like industry associations • Media sources	• Working groups • Contact with editors	• Publications from associations • Scanning media, especially internet research or patent research
Government	• Governmental departments	• Visiting respective website • Scanning new technology regulations	• Attend in national and international fund programs of innovative projects • Scanning commentaries concerning new laws
Suppliers	1. Suppliers of physical goods like tier-one and/or tier-two supplier, etc.	• Supplier submitted ideas • Meetings • Contract negotiations	• Supplier analysis • Research for news from suppliers
	2. Supplier of information, like consultants and research firms	• Direct talks • Visiting presentations • Networking	• Working with database of consultants • Use of provided information services

Table 6-3: Overview of External Idea Sources at KSPG

Usually KSPG has access to a lot of possible external idea sources like the ones shown in Table 6-3 which they could capitalise on. Some typical problems with the utilisation of these external idea sources are:

- Information of these external idea sources is widely spread within the company.
- No central storage of this knowledge exists.
- There is no systematic knowledge management implemented so far.

So the collection of information must be carried out individually, and it is necessary to know the right contact person within KSPG for the collection of specific information about and from the external idea sources.

To achieve sustainable innovation success, it is important to obtain internal acceptance for the usage of external idea sources. One possible way is to use internal contact persons for the collection of external ideas first. However, it is important to minimise the individual work effort for the internal contact person to get information from external stakeholders, and to share this knowledge with other colleagues. When this approach is applicable it makes sense to widen the sources of ideas within the specific categories of external stakeholders which are not fully integrated in the idea generation process. Thus, the exploitation of external idea sources is first of all an internal step-by-step process.

In the context of this thesis, one important step in the direction of a better collection of customer ideas at KSPG was our creation of permanent customer-related teams with team members from all KSPG sales divisions (Figure 6-8) [NEU2011c]. The main tasks of these teams are:

1. Build-up knowledge about KSPG customers and share these customer insights with team members.
2. Development of a homogenous and consistent understanding of the customers' future production plans and capacities, which represents the KSPG level of information and which is binding for all business divisions.
3. Discussion of the customer-related topics and estimation of a final result, which represents KSPG's common market view.

Members of these teams have the possibility to share their knowledge with colleagues, and make their market estimations transparent. For the management of these KSPG Customer Teams (i.e., sales people in particular), we created an IT solution within the KSPG's intranet, the so-called team room. Thanks to this new facility, it is now possible to collect and to store systematically the data provided by the customer team members. Among these data there will be invaluable customer ideas, which will be fed into the Innovation Database and thus into the complete ideation process.

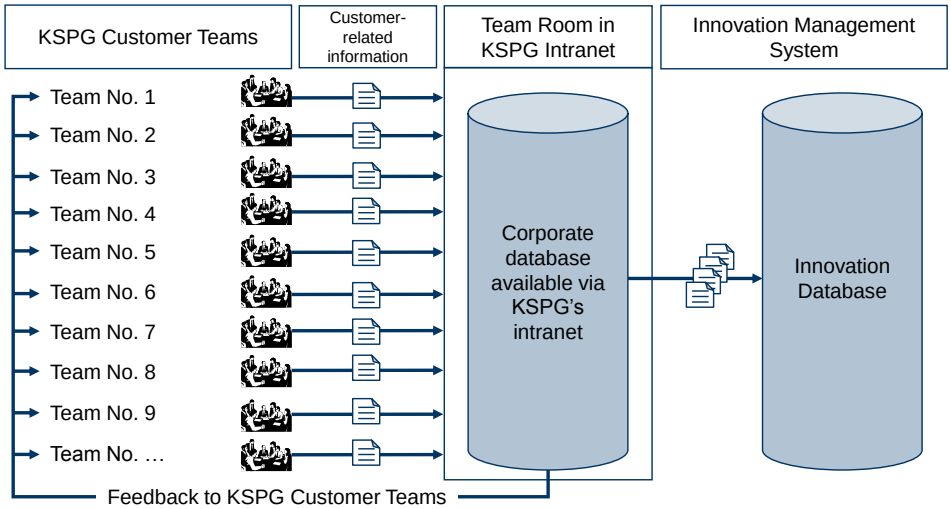

Figure 6-8: Customer Teams help capitalise on Customer Ideas [NEU2011c]

Further external idea sources for innovation purposes should be definitely used to obtain the targeted improvement of idea generation at KSPG. The major challenge of this will be to find those methods and tools that can be applied to KSPG in a way that they fit into the current organisational culture, while at the same time leading to the desired cultural transformation regarding open innovation.

6.5.4 Step 3: Design of a KSPG-specific Ideation Process

Based on the key success factors of ideation (see Chapter 5.3.1), all the identified KSPG-specific action fields (see Chapter 6.5.2) and the determining factors of KSPG's organisation (see Chapter 6.5.3) our design of a company-specific adaptation of the ideation reference process model (Chapter 5.3.2, in particular Figure 5-2) to KSPG followed a systematic procedure: for each of the stages, gates, and associated actions we analysed the corresponding organisational and cultural elements, activities, and tools that would be concerned at KSPG. We aimed at finding out which roles to assign to these entities, and where to place them in the ideation process such that the key success factors and the KSPG-specific action fields can be taken into account.

In Figure 6-9 we present the resultant KSPG-specific ideation process, which is the result of very valuable discussions, especially with the head of Advanced Engineering, and accepted by the top management from the central department Research and Technology of KSPG in Mai 2012.

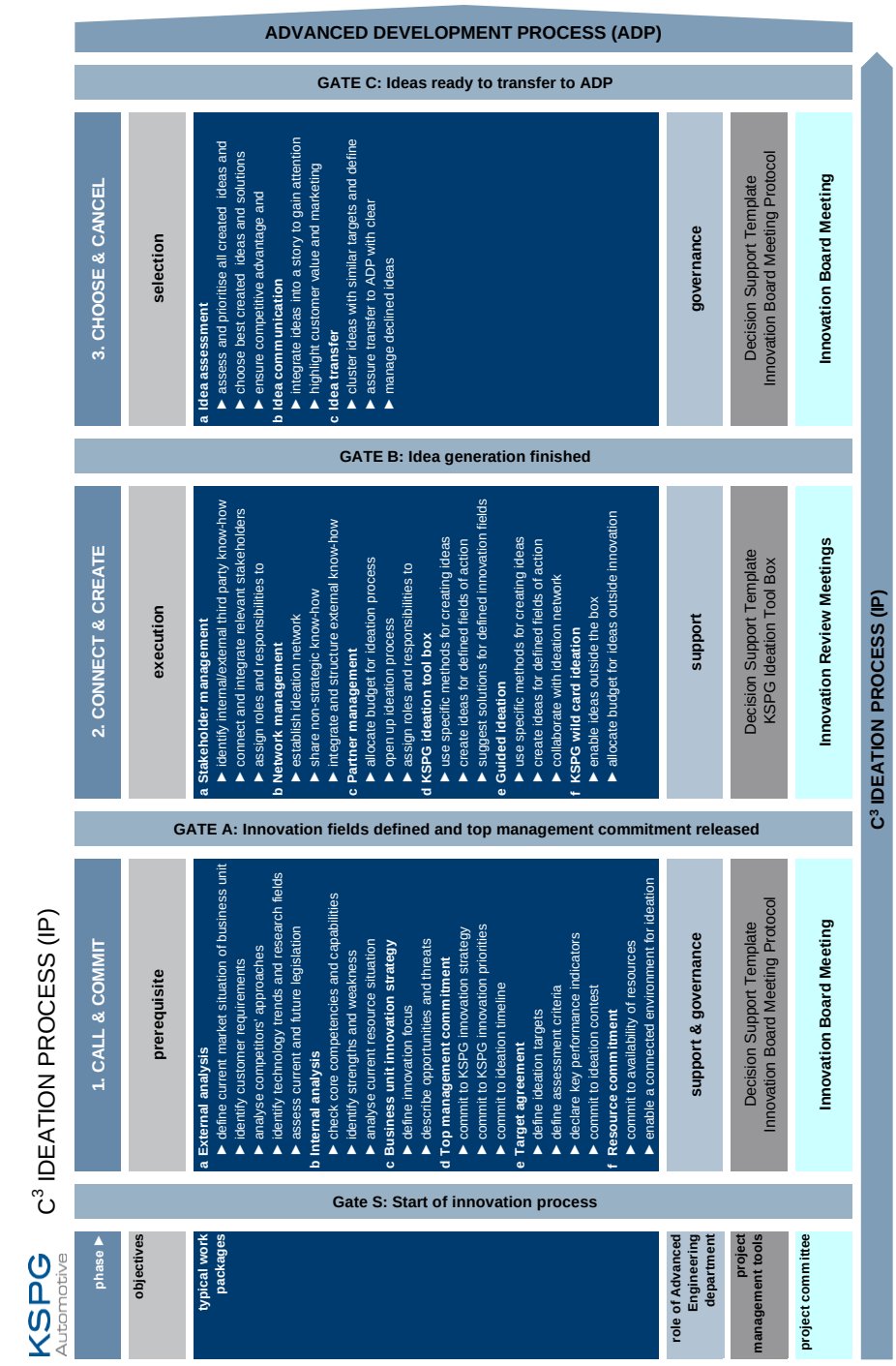

Figure 6-9: KSPG-specific Ideation Process – C^3 Ideation Process (IP)

We aligned the design and configuration of the KSPG-specific ideation process with the main focus of active idea generation and effective idea selection, but also to promote ideation and manage ideation activities. For example, that was the reason for the eye-catching name "C^3" and the description of the stages as

- Call & Commit,
- Connect & Create, and
- Choose & Cancel.

So the ideation process should attract attention and be memorable for the employees of KSPG, which will also ease the upcoming related campaigns.

Every stage, action, and gate (decision point) corresponds to one or more key success factors and/or a field for priority action identified in Step 1. Table 6-4 presents the mapping of the KSPG-specific action fields.

KSPG-specific Ideation Process Phase	Ideation Activities	Tools / Methods for the Implementation	KSPG-specific Fields of Action
Call & Commit	External Analysis	• Decision Support Template • Innovation Board Meeting • Innovation Board Meeting Protocol	A1 and A2
	Internal Analysis		
	Business Unit Innovation Strategies		
	Top Management Commitment		
	Target Agreement		
	Resource Commitment		
Connect & Create	Stakeholder Management	• Decision Support Template • KSPG Ideation Tool Box • Innovation Review Meetings	A3 and A4
	Network Management		
	Partner Management		
	KSPG Ideation Tool Box		
	Guided Ideation		
	KSPG Wild Card Ideation		
Choose & Cancel	Idea Assessment	• Decision Support Template • Innovation Board Meeting • Innovation Board Meeting Protocol	A5
	Idea Communication		
	Idea Transfer		

Table 6-4: Mapping of the identified Fields of Action with the phases of the KSPG-specific Ideation Process

Call & Commit

The first stage Call & Commit corresponds to the prerequisite stage from the ideation reference process model (see Chapter 5.4). This phase of the KSPG Ideation Process focuses on the call for a high-quantity of high-quality ideas. The visible order for ideation comes from the management board based on previous internal and external analysis of the business units. The business units have to define their innovation focus und describe opportunities and threats. These assumptions find their way into the overall KSPG innovation strategy and innovation priorities, which are committed by the management board. This board will also set a timeline for the ideation activities. To assure the quality of ideation, top management provides agreed targets and the needed resources, including the possibilities to generate ideas in a connected environment.

Connect & Create

The next stage Connect & Create follows the generation stage of the ideation reference process model (see Chapter 5.5). The main aspect of this phase of the KSPG Ideation Process is that ideation has to happen in networks of internal and external stakeholder and partners. KSPG has to capitalise on internal and external expertise. Possible idea sources have been already be identified by our stakeholder analysis (see Chapter 6.5.3). The top management has to find a way to find the right balance between the freedom for creativity and its entrepreneurial and commercial objectives and support the ideation activities with organisational changes in the corporate culture.

Choose & Cancel

The last stage Choose & Cancel is equal to the selection stage from the ideation reference process model (see Chapter 5.6). This phase is exclusively dedicated to the identification of the most promising ideas for innovation and the transfer of these right ideas to the ADP. In the past, this selection of ideas was not always very transparent. With the KSPG-specific ideation process there will be more dynamic and interaction with the several business units. This phase will encourage a competitive spirit amongst the business units to present the best ideas to the management board to gain the required resources for advanced development. This competition shall motivate the actors of the ideation process to generate high-quality ideas.

The whole KSPG-specific ideation process matches exactly with the standards of process visualisation in the company, and is placed in front of the ADP (Figure 6-10). In accordance with the company's quality standards, documents and models have been created for all scheduled meetings, as well as most of the tasks and tools. Taking into account the existing documents and processes at

KSPG was essential to facilitate the introduction of the new process and the transformation of the corporate culture of ideation.

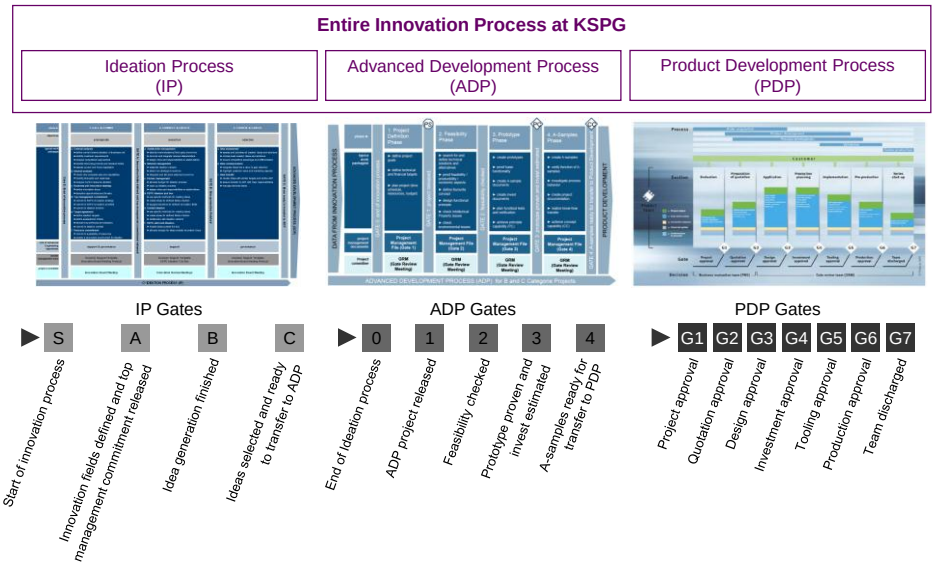

Figure 6-10: KSPG-specific Ideation Process embedded in the entire Innovation Process

The company-specific ideation process requires the introduction of specific tools and methods that will help to implement the process in the company's particular corporate environment.

Decision Support Template

The Decision Support Template is the principal document during the Call & Commit stage of the ideation process. It accompanies the whole range of activities during this stage. It is essential for the management to make employees report the numerous results of each activity, from the external analysis to the needed resources.

The Decision Support Template formulates decision points as a preparation for the first Innovation Board Meeting and therefore prepares decisions from the management board. It is also applied at the second Innovation Board Meeting.

Moreover, it describes the implementation planning of the subsequent Connect & Create process stage. The KSPG Decision Support Template can be found in the Appendix of this work.

Innovation Board Meetings

The Innovation Board Meeting is very important because it represents the manifestation of the top management's commitment. There will be two Innovation Board Meetings per year. The first meeting places the active Call & Commit for ideation under the patronage of the top management. This Innovation Board Meeting concludes the prerequisites and gives the go-ahead for the next stage, the Connect & Create stage.

The decision-points, which have already been prepared in the Decision Support Template by then, will be discussed and finally agreed. In addition to this decision-making, the top management grants mandates to the business units to implement executive orders within the framework of KSPG's ideation process. The result of the first Innovation Board Meeting is the completion of Gate A, where the innovation fields are defined, and the top management commitment is sealed.

The second Innovation Board Meeting marks the end of the Choose & Cancel stage. The suggested ideas and solutions that have previously been assessed as the best potential ADP projects, are chosen and transferred to the ADP. The top management decides about the necessary responsibilities and resources. Thus, this Innovation Board Meeting results in the final decision-making of Gate C, where ideas are selected and made ready to be transferred to the ADP.

Innovation Board Meeting Protocol

The decisions made during the Innovation Board Meetings have to be documented. With the Innovation Board Protocol, the explicit approval of Gate A and the final release of Gate C are recorded in a written form. This way, all the participants of the Innovation Board Meeting have the certainty about the top management's commitment and the decided tasks, responsibilities and resources.

Furthermore, this document helps to manage and control the ideation tasks. The Innovation Board Meeting Protocol can be used to communicate the defined contribution of each actor in the ideation process. The KSPG Innovation Board Meeting Protocol Template is in the Appendix of this work.

KSPG Ideation Tool Box

During the execution stage—the so-called Connect & Create—, the KSPG Ideation Tool Box shall facilitate creativity and the generation of ideas.

The main reason for our proposed KSPG Ideation Tool Box is that we want to bring together the individual experts systematically in our recommended KSPG Ideation Meetings (see Chapter 6.5.3). However, it really matters how to conduct these meetings. The KSPG Ideation Meetings shall facilitate a

maximum of creativity, but also be held in guided and controlled manner to achieve a specific goal. Current comparable meetings at KSPG are either completely formal or too chaotic. Therefore, we see the need to introduce organised KSPG Ideation Meetings and the establishment of tools that allow an effective and efficient guidance through the meeting.

The KSPG Ideation Tool Box is based on experiences of the research team and relates to the specific organisation of the company and the ideation topic. We decided to put these methods into the KSPG Ideation Tool Box (see Appendix), which were identified through our expert interviews (see Chapter 5.2.2) and our analysis of the current situation at KSPG (see Chapter 6.5.3). This Ideation Tool Box represents a bunch of methods, which a company can easily apply during the idea generation phase and are considered as extremely valuable because they have been repeatedly tested in practice to be effective in generating promising ideas [BAC2007], [NÖL2010].

Nevertheless, this repertoire of tools can be continuously enlarged. The choice for one specific or the combination of multiple tools depends on the certain problem or desired solution.

Innovation Review Meetings

During the Connect & Create stage, the Innovation Review Meetings make sure that the communication between the numerous business units and the Advanced Engineering department works and if it provides general support. We recommended that this Innovation Review Meeting be held at least twice during this execution stage in order to make sure that the idea contributors get sufficient feedback and guidance.

Finally, the last Innovation Review Meeting in the Connect & Create stage is the right platform to close this ideation process phase by approving Gate B.

All these measures aim at involving internal and external stakeholders of the company with more focus, more challenge, and more involvement.

6.5.5 Step 4: Feasibility Demonstration

In the scope of this thesis, top management asked us to demonstrate the feasibility to the prerequisite stage (Call & Commit) of the ideation process using the topic of E-mobility.

The current perception of the top management at KSPG of this topic can be summarised in the following core statements:

- OEMs focus on electric cars and the electrification of the powertrain. These decisions are driven by environmental political decisions.
- Because of its product range, which emphasises on combustion engine, KSPG is not noticed by the OEMs as a partner for developments in the field of E-Mobility. Thus, KSPG risks to be excluded from these future developments in the long run.
- Through the development of the Range Extender in cooperation with the company FEV, KSPG has done a first important step towards a strategic orientation towards E-Mobility.

Against this background, we had the possibility to verify our general considerations concerning the KSPG ideation process with special regard to our designed ideation tools and methods.

We had several discussions with the head of the New Propulsion Technologies department about proposed ideation process and its practical implementation to E-Mobility as ideation topic. His assessment was very positive, and he underlines in particular the necessity of all the actions that we propose in the prerequisite phase.

Guided by the structure of the Decision Support Template, we discussed each particular issue related to the prerequisite phase, and filled out the Decision Support Template accordingly. Subsequently we presented this document to the top management, who agreed that it was valuable support for them and a significant improvement compared to the current situation.

6.5.6 Step 5: Concept Proposal for the Introduction

Due to a very recent major re-organisation involving the R&D department in particular, the final decision by the top management how to implement the KSPG-specific ideation process is still open at the time of writing this manuscript. The major issue is the scope of the organisation that should be involved in the introductory stage, and the financial governance. However, the final decision is expected in late autumn 2012.

In the context of this thesis, we prepared this introduction step well by working out a concept proposal for the introduction of the KSPG-specific ideation process. Thus, we have come up with an implementation planning, which can be executed as soon as it comes to a decision. This implementation proposal includes the following main points to be realised by the Innovation Services department:

1. General preparations concerning the implementation of the KSPG-specific ideation process:

(a) supporting the decision-making and final release regarding the KSPG-specific ideation process,

(b) elaborating and coordinating a time schedule for the implementation of the ideation process,

(c) supporting the communication and the rollout of the KSPG-specific ideation process and its associated ideation tools within KSPG,

(d) identifying and involving promoters for the successful implementation of the ideation process within KSPG,

(e) defining interfaces between the different actors and their responsibilities through the whole KSPG-specific ideation process,

(f) defining the paths and forms of communication during the KSPG-specific ideation process,

(g) planning of time schedule for the entire implementation,

(h) governance during the whole process to ensure ideation progress at KSPG.

2. Measures regarding the Call & Commit stage:

(a) preparation of the Innovation Board Meeting,

(b) supporting business units' internal and external analyses,

(c) ensuring and company-broad communication of management decisions and executive orders of the Innovation Board Meeting.

3. Measures regarding the Connect & Create stage:

(a) identification, nomination and motivation of experts to put together in dedicated ideation teams,

(b) supporting the establishment of ideation networks within and without KSPG,

(c) supporting the KSPG Customer Teams,

(d) coordinating trainings regarding the KSPG Ideation Tool Box,

(e) moderated and targeted application of the KSPG Ideation Meetings according to the KSPG Ideation Tool Box,

(f) initiation and support of Innovation Review Meetings,

(g) supporting the elaboration of the idea proposals according to the evaluation criteria specified in the Call & Commit stage.

4. Measures regarding the Choose & Cancel stage:

(a) preparation of Innovation Board Meeting,

(b) supporting the evaluation and selection of project ideas,

(c) ensuring the transfer of selected project ideas to the ADP,

(d) ensuring the feedback of deferred ideas in the next ideation cycle,

(e) ensuring of further processing of declined ideas.

5. Measure regarding the assurance of learning in the organisation:

   (a) documentation about the application of the KSPG-specific ideation process,

   (b) identification of lessons learned,

   (c) identification and application of improvement measures.

At the end of this implementation process, the results, as well as the applied methodology will be critically assessed against numerous criteria, such as performance, effectiveness, applicability to other companies and sectors, etc.

6.5.7 Step 6: Accompaniment of the Introduction

Our overall objective is to validate our reference ideation process in the corporate context of KSPG. This means that we will cause an organisational change towards open innovation with the introduction of the process. This change has to be accompanied. Due to its highly competitive and strategic nature, our validation project is

- the subject of long negotiations with top management,
- a project that requires financial investments from the entire organisation,
- a project whose effects are visible and assessable only in the medium-term or even long-term,
- a project that involves many parts of the company's organisation, and
- a process of transformation of the company's organisational culture.

All these factors make the acquisition, launch, and support of such a project difficult and incur an intensive investment of time and effort. Nevertheless, we expect several positive effects to result from this project:

- The project will come up with a clear documentation of the approach that has been applied, and the experiences gained from it. It will also deliver a critical assessment of each step, as well as of the global result in order to validate the process.

- It will create a positive attitude of stakeholder groups with respect to their own involvement in the ideation process.
- It will open the mindset of the affected stakeholders for changes that will significantly contribute to the improvement of the organisation's innovation power.
- The project will deliver an increased number of new ideas contributed by several experts from different fields.

The implementation of the KSPG-specific ideation process will establish a learning cycle in the sense of gaining experiences through living the process. Increased practices and learned skills will lead to a successive improvement of the process description, which is enriched by empirical values. This will help the company's management and employees to handle the KSPG-specific ideation process much better.

A large-scale validation will occur from late autumn 2012 when the KSPG-specific ideation process will be launched at the level of the entire organisation. The top management of the departments Research and Technology and also Advanced Engineering support the introduction of this new process.

6.5.8 Added Value for KSPG

The key target of the case study was to propose KSPG a systematic approach of moving from a classical, technical idea collection toward an innovation management that addresses the active generation and target-oriented selection of ideas. We awakened the need for a KSPG-specific ideation process and achieved to convince the top management for its implementation within the company.

They see the long-term added value of our efforts in establishing the KSPG ideation process company-wide. Table 6-5 compares shortly the situation at KSPG before and after the derivation of a KSPG-specific ideation process and summarises the added value for KSPG that resulted immediately from our work on this case study.

Before Derivation of a KSPG Ideation Process	After Derivation of a KSPG Ideation Process	Added Value	Reference
• Few information about best practice	• Findings from external interviews	• Knowledge about best practice	• Chapter 5.2.2
• No defined success factors of ideation	• Findings from literature research and external interviews	• Defined key success Factors for the ideation process	• Chapter 5.3.1

• Loosely defined fields of action concerning ideation	• As-is analysis of the existing innovation process at KSPG with focus on current innovation management	• Clearly formulated fields of action	• Chapter 6.3.3 • Chapter 6.5.2
• No systematic analysis of the organisational aspects that facilitate an innovative corporate culture	• Analysis of the current organisation situation and corporate culture at KSPG	• Determination of KSPG organisational elements that influence ideation	• Chapter 6.5.3
• Idea sources not clearly identified	• Internal and external stakeholder analysis	• Opportunities to involve internal and external stakeholders as idea sources into the ideation process	• Chapter 6.5.3
• No clear process for the fuzzy front-end of the innovation process	• Design of a KSPG-specific ideation process based on the ideation reference process model	• KSPG-specific ideation process with associated KSPG-specific methods and tools	• Chapter 5.3.2 • Chapter 6.5.4 • Figure 6-9
• No active idea generation, only idea collection	• Design of the stages Call & Commit as well as Connect & Create is focused to lever active idea generation	• Idea generation oriented innovation management system	• Chapter 6.5.4
• No methods and tools for active idea generation	• Decision Support Template • Innovation Board Meetings • Innovation Board Meeting Protocol • KSPG Ideation Tool Box • Innovation Review Meetings	• KSPG-specific methods and tools for ideation	• Chapter 6.5.4 • Appendix
• Idea selection not systematic and transparent	• Design of the stage Choose & Cancel is primarily dedicated to support effective and efficient idea selection	• Confidence in future decision-making regarding upcoming ADP projects	• Chapter 6.5.4
• No internal marketing of innovation management	• Visualisation and "branding" of the KSPG-specific ideation process as "C^3"	• KSPG-specific ideation process fits into the existing process landscape and provides elements that are	• Chapter 6.5.4 • Figure 6-10

		easy to communicate	
• No guideline for implementing a company-wide process for structured idea generation and idea selection	• Concept Proposal for the Introduction of the KSPG-specific ideation process	• To-do-list for the implementation of the KSPG-specific ideation process	• Chapter 6.5.6

Table 6-5: Added Value for Innovation Management after the Derivation of a KSPG-specific Ideation Process

Based on the results and experiences of the case study, the major impact of the KSPG-specific ideation process is the increased level of information available to the top management of KSPG. The initially very fuzzy early innovation activities have become significantly more transparent and organised.

Our work on this case study and additionally our findings from the expert interviews (see Chapter 5.2.2) confirmed that the need for a systematic ideation process is widely spread in automotive industry. KSPG represents no special case, it is rather a very typical example within this sector. The implementation of the KSPG-specific ideation process is the first step in the right direction to reinforcing ideation and consequently leveraging innovations.

Part IV:

Global Conclusion

7 Conclusion

Every innovation is based on an idea whose appearance marks the starting point of innovation activities. Because of the increasing innovation pressure today, it is indispensable for companies to not only wait for the birth of good ideas, but rather to act pro-actively in facilitating the generation of ideas with commercialisation potential.

The generation of ideas usually happens in the blurry cloud in the front of the innovation process. Researchers in the field of NPD call this phase "fuzzy front-end". Right here in this stage of innovation, companies have to encourage the creativity. They see themselves confronted with the problem of stimulating the generation of ideas on the one hand, and on the other hand they want to manage this phase in an organised and targeted manner to cope with resource restrictions.

Our contribution to solve this dilemma is built on the following main pillars:

1. We defined and introduced the term ***ideation*** to describe more precisely the procedure of idea generation and selection for innovations (see Chapter 3). This enabled us to focus our research work and to position ideation at the very ***beginning of the fuzzy front-end*** of the existing definition of the entire innovation process.
2. Based on our ***literature research*** (see Chapter 5.1) and ***expert interviews*** (see Chapter 5.2) we were able to define ***key success factors for ideation*** that are applicable to any specific organisation (see Chapter 5.3.1).
3. Based on these key success factors we created an ***ideation reference process model*** (see Chapter 5.3.2) that follows the principles of stage-gate processes. The mapping of the key success factors to the ideation reference process model provided us an output-oriented structuring of the activities during the primary steps of the fuzzy front-end.
4. By developing the ideation reference process model we discovered the prominent role of the ***systematic involvement of internal and external stakeholders in the entire ideation process*** that implies a cultural change towards open innovation. With our ideation reference process model we

provide an approach to how this cultural reorganisation can be initiated and processed.

5. We described ***major aspects of every phase of the ideation reference process model*** regarding to more opened ideation activities and their practical implementation (see Chapters 5.4, 5.5 and 5.6). Our ideation reference process model, its description, and the proposed implementation methods are generic enough to be applicable in several different business sectors as a guideline because of its template character.
6. We introduced the specific characteristics of the context of our ***case study***, which is in the automotive industry sector. We had a particular look at the innovation management processes, needs, and culture of occidental automotive OEMs and suppliers (see Chapter 6.2).
7. We derived a ***company-specific ideation process*** to validate our ideation reference process model within the corporate setting of the automotive supplier KSPG Automotive Group in Germany and developed methods and tools which are tailor-made to meet this company's requirements (see Chapter 6.5.4).
8. We prepared a ***detailed implementation proposal*** for the corporate-wide rollout of the company-specific ideation process (see Chapter 6.5.6). In the context of this work, integration means that the ideation process has to be realised in the company's process landscape and organisational environment. The ideation process, which did not exist prior to our work, has been added to KSPG's official process landscape, including the governance structure required for its implementation within the organisation.

In terms of the positioning of our results in the research landscape, the creation of an ideation process was generally determined by our intention to combine aspects from modern innovation management with NPD research results. With our ideation reference process model we succeeded in recommending a structure of the very beginning of the fuzzy front-end, and consequently we achieved to ***link the subject of ideation with NPD research***. With the derivation of a company-specific ideation process from our generic ideation reference process model we were able to transfer our academic results directly into an industrial context.

Due to the fact that the early phase of the innovation process represents a very recent field of research, we believe that our approach closes some gaps and represents a very good compromise to make dynamic ideation activities systematic while at the same time keeping up the high level of creativity that is necessary to let new ideas flourish.

8 Perspectives

Our research work is located at the intersection of three scientific disciplines: engineering sciences, economic sciences, and social sciences. The term "ideation", which nourishes the innovation process in its very beginning, is the element in the centre of this intersection that represents the connection between these three sciences. This multidisciplinary nature gives rise to numerous research and validation projects in a variety of different contexts with respect to our initial research question: "How is it possible to create a structured approach towards effective and efficient ideation?"

We consider the value of our research very important, particularly because there are only few comparable studies that deal with the very beginning of the fuzzy front-end of the innovation process. Although our research results satisfied our expectations, they also inspired us about several aspects which we could not cover in this thesis, but which we consider absolutely worth investigating. In the following, we briefly outline these research perspectives.

Evaluation of the Success Factors of Ideation

In the scope of this work, the validation of the identified success factors was based on qualitative research, namely expert interviews. Due to this selected methodology, we were confronted with two kinds of restrictions, like the sample size as well as the lack of variation of professional affiliation. However, this limitation provides a starting point for future analyses.

It is clear that experts dedicated to innovation management are indeed aware of the hurdles concerning ideation. Future efforts would benefit from the incorporation of larger and/or more varied interview samples that include more experts from other business sectors, or stakeholders (like e.g. researchers or consumers). The enlargement of the sample size towards the fulfilment of constraints for a quantitative research design may provide the statistical proof of the success factors.

Evaluation of the Ideation Reference Process Model

The next essential step in our research is to validate and improve our generic ideation reference process model according to the results of the implementation of the company-specific process at KSPG. To complete the full picture, the efficiency of our approach has to be evaluated.

However, most of the known indicators used to assess the performance of business processes are not suitable to achieve reliable and useful evaluation results of the ideation process. Due to its position in the fuzzy front-end of innovation, ideation exhibits complex characteristics which are difficult to measure. Therefore tools and methods have to be found to gather the data to determine the assessment criteria for validating the performance and maturity of the ideation process.

Despite this general assessment problem, it is very important to derive from our ideation reference process model other company-related ideation processes. Because with the increasing amount of company-specific processes, more case studies are available providing usable experiences from practise and valuable lessons learned. As a Russian proverb says: "Repetition is the mother of learning" [MER1995].

These future case studies have to aim at varying

1. the sectoral context of the company, or
2. the existing management approach in the company, or
3. the size of the company.

Regarding the first objective the company can operate in one of the following three sectors:

Group 1: case studies from automotive industry,

Group 2: case studies from non-automotive but technology-driven industries, and

Group 3: case studies from non-technology-driven industries.

Such results will help evaluate the universal applicability of our ideation reference process model.

With respect to the second objective, the existing management approach, we want to revive an eminent finding of Khurana and Rosenthal [KHU1998]. Based on their case studies they found out that they have to take two contrary management approaches into account for their holistic front-end model [KHU1998]:

1. Formality in the front-end:

- process orientation,
- explicitness of product definition and related issues, and
- broad business perspective.

2. A culture-driven approach:
   - strong organisational culture based on cross-functional interactions,
   - "subtle control", i.e., ambiguous direction from management, and consensus and agreement among development stakeholders, and
   - deep understanding of new product development, including complex interactions, by key organisational members.

During our research work, we have seen these two different managerial directions confirmed and we recognised that the need of a generally very abstract topic like idea generation and idea selection in the form of structured process is typical for process-driven organisations of occidental countries. From our point of view, companies from this part of the world will drive the integration of an ideation process like ours. Therefore, it is evident that future research may focus on this special cultural aspect.

The last objective addresses studies from companies of different sizes. Especially large and established companies are confronted with the problem of organisational inertia and change resistance regarding radical innovations and new processes. Social systems like organisations and corporations develop standards and routines for stabilisation and complexity reduction [GLO2011]. While mature technologies and successful behaviours are seen as reliable, highly innovative intentions will be ignored for fear of the operation of the company [AHU2001]. Adjustments of the status quo in form of incremental innovations are preferred to radical innovations. This preference of well-known solutions results in the organisational dilemma that social systems try to prevent innovations although they need them to survive [POH2005].

Facing these characteristics of large end established companies, further research may survey how well our ideation process performs in small and medium sized companies.

Indicators and Assessment Criteria to Evaluate Ideas during the Process

Generally speaking, every idea is a good idea. In order not to restrict the creativity of the stakeholders involved in the ideation process, we have to consider that any idea is good and relevant for a defined subject at the start of the process.

Thus, depending on the available budget and the resource restrictions, it is necessary to prioritise ideas according to their potential of becoming successful innovations on the market, but without losing the other less promising ideas, which may turn into high-potential ideas in the near or far future when the context changes. One major milestone of our ideation process is the presentation of new ideas worthy to pass the money gate. As a result, it is essential to define and communicate indicators and assessment criteria to monitor ideas during the process and rate their commercial success.

However, which indicators and assessment criteria to use? Are there any evaluation criteria which can combine subjective estimations about vague future trends with objective indicators that assess the potential of an idea? The identification of such criteria will provide the stakeholders of the ideation process the means and tools to calculate these indicators and to present them in suitable manner for decision makers to facilitate their judgements.

These questions have been partly answered, albeit with particular regard to the interests of KSPG. A more fundamental and generic treatment of this important subject is yet to be done.

Stakeholder Integration

As a part of this work we have identified that nowadays idea management is mostly related to the corporate suggestion system, which addresses all employees to contribute ideas for the improvement of the internal processes of the own company (see Chapter 3.1.1). But typically, ideas for new products and services of the company are not processed by these methods. Instead, innovation is considered to be the subject of only a few employees mostly in leading positions.

One major aspect of this thesis is the hypothesis that the integration of different experts in the process of ideation—more precisely in the creation and assessment of ideas—must contribute significantly to increase the number, the quality and the relevance of received ideas. Due to the constraints of our case study's company and the time that is necessary to make a new process alive in a large organisation, we could only validate this hypothesis on a small scale. Therefore follow-up research projects should be launched in several companies, primarily aiming at doing a quantitative assessment of the effects due to the integration of different experts in the ideation process.

In addition, we believe that these effects play a significant role for the sustainability of the innovations based on the generated ideas, because these ideas have been evaluated and developed by diverse stakeholders involved in several different phases of the ideation process and subsequently in the downstream phases of the entire innovation process. Because of their

experiences and different perspectives, the different domain experts can help to ensure that the ideas and their implementations meet the criteria best that are decisive for market success. This assumption leads directly to open innovation, one of the major topics of the current innovation research that is based on the active involvement of external stakeholders in the internal organisation of the company to make them participate in the creation and evaluation of ideas. These external stakeholders include customers, suppliers, partners from research and development, etc. Even competitors and their customers can be interesting sources of new ideas.

With our research work we partly showed how this open innovation could be realised in a well-established sector like the automotive industry. But final results about the practical instruments for the stakeholder integration and regarding the value of adding different internal and external expertise into the ideation process are still missing.

For the application of the open innovation paradigm it is necessary to find the specific measures and tools to integrate all internal and external stakeholders into the ideation process without endangering the competitiveness and confidentiality. This offers another possibility for additional research. Furthermore, it could be interesting to investigate which added value for the company can be achieved with this stakeholder integration, and which measures are needed to make these stakeholders perform better in the ideation process.

These subjects—stakeholder integration and open innovation—propose a wide range of further research and studies.

Evaluation of the Long-term Impact of Ideas on the Innovation Success

The ideation reference process model ends with the transfer of promising ideas to the NPD. Here the main question still remains: Which innovation success will these ideas actually have? Which products or services have been realised based on these ideas? Are they commercially successful on the market?

These questions can only be answered after a certain period of time. The evaluation of this success is—compared with the already described difficult evaluation of the entire ideation process and the ideas during the process—more straightforward because objective financials and innovation controlling are applicable here. Hauschildt and Salomo present an overview of practical key indicators, which will help to rate the success of innovations [HAU2011]. These criteria are categorised according to the effects they measure (see Figure 8-1). Generally, the innovation success can be evaluated by its economic, technical or other—system-related or individual—characteristics.

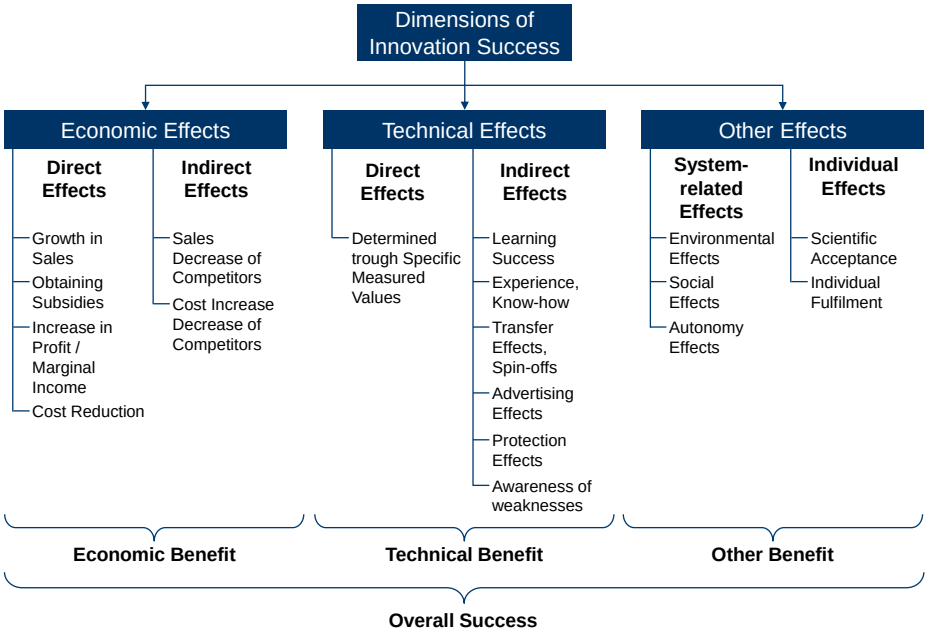

Figure 8-1: Criteria for the Evaluation of Innovation Success [HAU2011]

The direct economic success can be measured by profit and marginal income. Here it is important to define the time period covered by the income calculation. It has to be discussed how development costs have to evaluated and which inherent and eminent increase of know-how has been achieved without necessarily leading to tangible developments. The indirect economic success is related to its effect on the competition, like sales decrease (caused by patents) or cost increases (caused by licensing) of competitors. Direct and indirect economic effects are summarised as the "economic benefit" of the company.

The same approach is applicable for the determination of the "technical benefit", which is also composed of direct and indirect technical effects. Direct technical success has to be evaluated by specific project-related assessment criteria. Indirect effects of the technical success are for example learning effects, advertising effects, protection effects etc. Especially in the case of radical innovation these indirect technical effects can be more important than the direct technical effects.

Other dimensions of innovation success are caused by social effects on the individual and on the organisation. For example, for the inventor the scientific acceptance plays a major role or her or his personal fulfilment. On a company-level, the improvement of environmental conditions through the innovation is an example for a social and system-related effect.

To assess all the direct and indirect economic, ecologic and social effects, the total benefits will be determined as the "overall success". This evaluation of the long-term success of innovations could provide useful insights concerning the efficiency and effectiveness of the entire innovation process and the contribution of the systematic approach right from the start. Thus, another perspective resulting from our research work is the analysis of this long-term impact of ideation on innovation success.

Financing Ideation

Financing the ideation methods and tools is another issue that has to be investigated in future. Up to now, we have found that only very little information has been published about financing schemes supporting explicitly ideation activities as we described in our ideation reference process model. We did not deal with this issue in this thesis.

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Appendix

A1 – Interview Guideline for Expert Interviews

1. Introduction

1.1 Welcome and interviewer introduces himself shortly.

1.2 Explain the term "ideation": *Ideation denotes the procedure of idea generation and selection for innovations of products, services or business models with commercialisation potential on the market.*

1.3 Introduce the research question: *How is it possible to create a structured approach which explains ideation as the core task of the fuzzy front-end, and to implement this process in a company's environment such that it successfully facilitates innovation management in practice*?

1.4 Define research objectives:

- Creation of a generic ideation process model.
- Definition of indicators and assessment criteria to monitor ideas during the process and rate their commercial success.

2. Personal Information about the Interviewee

2.1 Company profile (industry sector, size, products, management ratios, competitors, etc.)

2.2 Expert's position and background (education, department affiliation, duration of employment, etc.)

2.3 Expert's function within the organisation (job description, main responsibilities, etc.)

3. Ideation Process

<Remark for interviewer: You can find the core subjects of the answers in this section in the following lists of key words. Please tick off mentioned issues. If aspect is not included in the answer of the expert, please inquire. See the list of key words as impulses / inspiration for the expert. Please complete lists with new aspects mentioned by the expert.>

3.1 Which internal and external sources are especially suitable for ideation?

Internal sources:

- ☐ *Executives*
- ☐ *Management*
- ☐ *Employees of all departments*
- ☐ *Sales representatives*
- ☐ *Think tank*
- ☐ *External employees*
- ☐ _____

External sources:

- ☐ *Customers*
- ☐ *Competitors*
- ☐ *Science*
- ☐ *Society*
- ☐ *Government*
- ☐ *Suppliers*
- ☐ _____

3.2 Which sources are the most important for your company?

3.3 In your opinion, what kind of organisational culture supports the generation of ideas?

3.4 What are the major principles that characterise your company culture?

3.5 Do structured processes play a major role in your company culture?

3.6 Does an ideation process exist in your company? How does your company structure the very beginning of the innovation process? What are the steps that your company goes through before a product is actually designed? Length of this? People and functions involved? Decisions made or not made? Formality of decisions?

3.7 What kind of idea generation methods does your company use?

3.8 What kind of idea generation tools (creativity techniques) does your company use for which specific purpose? Which tools are the most important?

- ☐ *Brainstorming*
- ☐ *Brainwriting*
- ☐ *Mind Mapping*
- ☐ *Cashier Method*
- ☐ *Brainwall*
- ☐ *World Café*
- ☐ *Ice Breaker*
- ☐ *Morphological Combinations*
- ☐ *Vision Building*
- ☐ *Concept Competition*
- ☐ *Six Thinking Hats*
- ☐ *Walt Disney Method*
- ☐ _____

3.9 What kind of indicators and assessment criteria does your company use to measure the success of ideas and to support the selection of ideas? How would you define "success"?

3.10 In your opinion, what are possible indicators and assessment criteria for the evaluation of ideas?

- ☐ *Advanced performance (basic input / expense)*
- ☐ *Budget requirements*
- ☐ *Competitive environment*
- ☐ *Conformity with technology trends*
- ☐ *Corporate risk*
- ☐ *Exclusiveness*
- ☐ *Level of innovation / novelty degree*
- ☐ *Market area /technology field*
- ☐ *Market Reach*
- ☐ *Need for the technical solution*
- ☐ *Required know-how*

- ☐ *Required resources / capacities*
- ☐ *Required workforce*
- ☐ *Speed of innovation*
- ☐ *Sustainability of technical solution*
- ☐ *Technical feasibility*
- ☐ _____

3.11 Are there any lessons learned from using an ideation process in your company?

3.12 Are there any problems with the ideation process at your company? Reasons? Solutions? Current practices?

4. Success Factors of the Ideation Process

<Remark for interviewer: Please confront the expert first with the following open-ended question. Do not intervene. Let the expert "brainstorm".>

4.1 According to your experience and/or considerations, what are key success factors of an ideation process?

<Remark for interviewer: After the expert finished her/his statement, confront her/him with the following list of success factors.>

4.2 In the following I will present to you a list of aspects that may influence the success of an ideation process. Please indicate your (dis)agreement with each of the aspects mentioned there.

Top Management Commitment

Relevant? ☐ Yes ☐ No

Involvement of a broad mass of employees

Relevant? ☐ Yes ☐ No

Resources for ideation activities in terms of time and budget

Relevant? ☐ Yes ☐ No

Analysis of market situation

Relevant? ☐ Yes ☐ No

Leaders of ideation activities

Relevant? ☐ Yes ☐ No

Integration of internal and external stakeholders in the ideation process

Relevant? ☐ Yes ☐ No

Interdisciplinary ideation teams

Relevant? ☐ Yes ☐ No

Promoters of ideas

Relevant? ☐ Yes ☐ No

Mentors of idea promoters

Relevant? ☐ Yes ☐ No

Creativity

Relevant? ☐ Yes ☐ No

Idea communication and (internal) idea marketing

Relevant? ☐ Yes ☐ No

Systematic and transparent pursuit of ideas

Relevant? ☐ Yes ☐ No

Practical indicators to monitor and select ideas

Relevant? ☐ Yes ☐ No

Rewarding schemes

Relevant? ☐ Yes ☐ No

4.3 What kind of roles, responsibilities, and interfaces are needed for the ideation process?

4.4 Which further processes, methods and systems are connected to the ideation process (decision-making process, communication paths, declined ideas, etc.)?

5. Final Issues

5.1 From your point of view, are there any further, not yet discussed aspects, which are important with respect to successful idea generation? Which ones?

5.2 Are there any suggestions you would like to make to improve the interview?

Thank you very much for your time and your cooperation.

A2 - Tools for the Implementation of the KSPG Ideation Process

Decision Support Template

KSPG Automotive

<Department Code>	**<Ideation Topic>**	<Date>

1. Current Situation

1.1 External Analysis

<Describe by reference to documents in the appendix current market situation of the BU, customer requirements, competitors' approaches, technology trends and research fields, current and future legislation>

1.2 Internal Analysis

<Describe by reference to documents in the appendix core competencies and capabilities, strengths and weaknesses, current resource situation>

1.3 Business Unit Innovation Strategy

<Describe by reference to documents in the appendix innovation focus, opportunities and threats>

KSPG Automotive

<Department Code>	**<Ideation Topic>**	<Date>

2. Decision Points

2.1 Implementation of an Idea Generation Process for e-Mobility

<Describe business unit innovation strategy, innovation priorities, ideation timeline>

2.2 Ideation Focus

<Describe subjects of the ideation process>

3. Assessment

3.1 Assessment of Business Unit Innovation Strategy

<Assess business unit innovation strategy, innovation priorities, ideation timeline>

KSPG Automotive

<Department Code>	**<Ideation Topic>**	<Date>

3.2 Assessment of Ideation Focus

<Assess subjects of ideation process>

4. Resources

<Describe resources needed for ideation process>

5. Governance

<Describe the proposed governance structure>

6. Implementation Planning

<Describe the implementation planning Connect & Create>

KSPG Automotive

<Department Code>	**<Ideation Topic>**	<Date>

7. Appendix

Appendix 1: …
Appendix 2: …
Appendix 3: …

Innovation Board Meeting Protocol

KSPG Automotive

Innovation Board Meeting Protocol **CONFIDENTIAL**

Name	Dictated by	Department	Date
Innovation Manager	IM	Z-FA	08.01.2013
	Subsidiary Neuss	Telephone	Fax

Subject:

Innovation Board Meeting, January 08, 2013
Gate A Ideation Process

KSPG AG

To
Explanation: Mailing List with M, Participant with P

A1	Executive Board	M/P	Z-F	Head of Research and Technology	M/P	...	...	...
A2	Executive Board	M	Z-FA	Head of Advanced Engineering	M/P	...	...	...
A3	Executive Board	M	Z-FB	Head of Central Engineering	M/P	...	...	...
A4	Executive Board	M/P	Z-FC	Head of New Propulsion Technologies	M/P	...	...	...

Explanation (Expl.)

T=Task D=Decision R=Recommendation S=Statement I=Info O=Open Point C=Completed D=Dead-Line

(Pos. No.) Position numbers in brackets were not discussed.

Pos. No.	Expl.	**Topic:** Task/Results	To be done for/by

Best regards,

signed Z-F / Head of Research and Technology signed Z-FA / Head of Advanced Engineering

Completed	In Process	Acquaintance

KSPG Ideation Tool Box

Ideation Tool	**Brainstorming** KSPG Automotive
What it does	• Generate a large number of ideas for the solution of a problem • Enhance creativity in the ideas
Basic rules	• Focus on quantity. The greater the number of ideas generated, the greater the chance of producing a radical and effective solution. • Withhold criticism. By suspending judgment, participants will feel free to generate unusual ideas. • Welcome unusual ideas. New ways of thinking may provide better solutions. • Combine and improve ideas. "1+1=3": Good ideas may be combined to form a single better good idea
Session conduct	• The facilitator leads the brainstorming session and ensures that ground rules are followed. • The steps in a typical session are: – Warm-up session to expose novice participants to the criticism-free environment – Facilitator: presentation of the problem – Participants: suggestion of ideas • When time is up: – organisation of the ideas based on the topic goal – Ideas are debated and categorized – Review to ensure that everyone understands the ideas
Preparation	• Set the problem • The problem must be clear, not too big, and captured in a specific question → e.g "What service for train users is not available now, but needed?" • If the problem is too big, break it into smaller components / questions • Create a background memo • The background memo is the invitation and informational letter for the participants, containing the session name, problem (in the form of a question), time, date, and place • The memo is sent to the participants well in advance, so that they can think about the problem beforehand • Select participants • A group of 10 or fewer members is generally more productive • Create a list of lead questions • Stimulating questions if creativity decreases during the session

Limitations	• Researches on real efficiency have been carried out • Result: Individual ideation more efficient than brainstorming, in terms of quantity and quality • Causes of efficiency low score: – distraction – social loafing – evaluation apprehension – production blocking • Nevertheless, these problems are not specific to brainstorming, but to group ideation in general.

Ideation Tool	**Brainwriting**
What it does	• Generate a large number of ideas for the solution of a problem • Enhance efficiency in ideation due to higher quality
Basic rules	• Ground rules • Defer judgment → no bad ideas • Quantity → more is better (don't worry about quality) • Freewheel → wild ideas are OK • Piggyback ideas → play off ideas of others • Write neatly & clearly → ideas fully understood
Session conduct	• The general process is divided in two major steps: • All ideas are recorded by the individual who thought of them. • They are then passed on to the next person who uses them as a trigger for their own ideas. • This process can be implemented in several varieties – Brainwriting Pool – Brainwriting 6-3-5 – Idea Card Method – Brainwriting Game – Constrained Brainwriting – Varying the level of constraint
Preparation	• Set the problem • The problem must be clear, not too big, and captured in a specific question → e.g "What service for train users is not available now, but needed?" • If the problem is too big, break it into smaller components / questions • Create a background memo

	• The background memo is the invitation and informational letter for the participants, containing the session name, problem (in the form of a question), time, date, and place • The memo is sent to the participants well in advance, so that they can think about the problem beforehand • Select participants • A group of 10 or fewer members is generally more productive • Create a list of lead questions • Stimulating questions if creativity decreases during the session
Limitations	• Researches on real efficiency have been carried out • Result: Individual ideation more efficient than brainwriting, in terms of quantity and quality • Causes of efficiency low score: – distraction – social loafing – evaluation apprehension – production blocking • Nevertheless, these problems are not specific to brainstorming, but to group ideation in general.
Brainwriting Pool	• Each participant gets a form. Problem is written on form. • 5 – 8 in group. • Each person writes three ideas at top and puts sheet in centre of table. • Participants take new sheet out of centre pile and add to it. • No rounds. Put sheets back and get new sheets at own pace. • Process completed at end of pre-determined time (e.g. 30 min). • Sort ideas.
6-3-5 Method	• 6-3-5 means: 6 pers. per group / 3 ideas per round / 5 minutes per round. • Divide everyone into groups of about 6. • Each participant starts with a prewritten brainwriting form with the problem at the top of the form. • First round: participants have 5 minutes to write 3 ideas. • End of each round: the form is passed to the person on the right. Each person reads all the ideas and adds 3 new ideas, which can be: – completely new – variations of ideas already on the sheet – additional developments to ideas already on the sheet • The process is completed when each participant gets his own form back, now filled up with many ideas. • The last step is to sort the ideas.

Idea Card Method	• Each participant gets a stack of index cards or index card-size post-its. Problem is written on visible board. • 5 – 8 in group. • Each person writes one idea on card and places it on his right side. • When participant runs out of ideas, they pick card from pile on left and try to add to it. – If they can't, they shift it to the pile on the right and get another card. – If they can add to the idea, they write it on a new card, attach the two cards together, and move both cards to the pile on right. • Moderator keeps cards circulating. • Process completed at end of pre-determined time (e.g. 30 min).

Ideation Tool	**Mind Mapping** KSPG Automotive
What it does	• Enhance creativity by graphically organising ideas • Encourage non-linear thinking • Gets rid of the vision of ideas on an individual level
Basic rules	• Focus on quantity. Just as in the Brainstorm, the greater the number of ideas generated, the greater the chance of producing a radical and effective solution. • Withhold criticism. By suspending judgment, participants will feel free to generate unusual ideas. • Emphasise graphical links. By organising your brainstorm graphically you might find unusual and innovative ways to tackle certain problems • The linking of ideas provides new opportunities in the field of indirect ideation.
Session conduct	• The facilitator leads the mind mapping session by setting a resolution on which ideas will relate to… • The resolution can be written, drawn, or both • Branches are drafted from this core statement while ideas are generated • Ideas can also be written and/or drawn • Ideas will be added to an existing branch or a new branch/sub-branch will be created • Branches can be linked with each other through common ideas
Preparation	• Use a big screen or board giving you enough space to write and draw • Start by writing or drawing your resolution in the centre of the area • Work around this key resolution and add ideas, strategies, etc. around it

	• Avoid working slowly, as judgment might compromise the quality of the exercise
Limitations	• Some people are not able to work with graphic representations • A linking of ideas enriches the field of ideation, but increases the complexity of the workshop

Ideation Tool	**Cashier Method**
What it does	• Creates a subconscious level of ideation • Continuous ideation process • Try to get rid of all external factors polluting a free ideation
Basic rules	• Very individual approach • Fully immerge into your brain's creativity. In its radical application the subject will immerge into unrestrained creativity by undermining self-censorship. • Set aside social structures. As society structures the way people think, groundbreaking ideas could be lost, as they might come from an unstructured and free approach to ideation. • Record ideas and thoughts without aiming any usage. This method should be used for pure uncensored ideation.
Session conduct	• No Ideation workshop, rather a "get together" discussion afterwards • During the early morning hours, preferably before having any social contact, each participant should take the time to reflect, while recording these reflections onto a notebook • A time frame should be set (e.g. a week) before collecting the results
Preparation	• Each participant is given – A time frame to run the activity – A notebook and a pen – Instructions on how (and possibly when) to use it
Limitations	• Very individual method of ideation • Often unrealistic application • Necessity from the participants of quite unrestricted commitment

Ideation Tool	**Brainwall**
What it does	• Visualises the sum of ideas • Offers space for physical connection (e.g. clustering)

Basic rules	• Ground rules • Defer judgment → no bad ideas • Quantity → more is better (don't worry about quality) • Freewheel → wild ideas are OK • Piggyback ideas → play off ideas of others • Write neatly & clearly → ideas fully understood
Session conduct	• Put ideas generated in a Brainstorming/Brainwriting session on the wall • Do not work on wall instantly • Listen to impulses, then after a while of distraction get back on wall • Keep all the ideas up on a wall for a while so that they can "percolate" with the involved people and perhaps spark additional ideas, combinations or concepts • Cluster ideas • Enhance visualisation by illustrator
Preparation	• Set the problem • The problem must be clear, not too big, and captured in a specific question →e.g "What service for train users is not available now, but needed?" • If the problem is too big, break it into smaller components / questions • Create a background memo • The background memo is the invitation and informational letter for the participants, containing the session name, problem (in the form of a question), time, date, and place • The memo is sent to the participants well in advance, so that they can think about the problem beforehand • Select participants • A group of 10 or fewer members is generally more productive • Create a list of lead questions • Stimulating questions if creativity decreases during the session
Limitations	• Researches on real efficiency have been carried out • Result: Individual ideation more efficient than brainstorming / brainwritting, in terms of quantity and quality • Causes of efficiency low score: – distraction – social loafing – evaluation apprehension – production blocking • Nevertheless, these problems are not specific to brainstorming / brainwritting, but to group ideation in general.

Ideation Tool	**World Café**
What it does	• Share views in a convivial atmosphere • Merge perspectives
Basic rules	• Generate ideas through a relaxed dialogue about a topic • Especially true for very heterogeneous teams • Helps the group to form bonds and share various perspectives on one topic • Especially useful: – At the beginning of workshops, as introduction to a new theme – As a relaxed but effective form of knowledge sharing after a stage of individual work
Session conduct	• Set four people at small café style tables (drinks might be served) • Set up 3 progressive rounds of conversation (3x30 min) • Predefined questions are discussed • Other small groups explore similar questions at nearby tables • Discussions are documented via writing or drawing • After one round of conversation, one person remains at the table, the others join other groups and take ideas, questions will be connected and with new input. • Same procedure in the second and third round • Whole group conversation might be brought up at the end
Preparation	• Prepare questions to be discussed • Print the questions / topics and dispose them on the tables • Install Idea Cards on the tables for writing or drawing
Limitations	• Researches on real efficiency have been carried out • Possible reduction of efficiency due to: – distraction – social loafing • Personal discussion – social/hierarchical inhibitions may hurdle free discussion

Ideation Tool	**Ice Breaker**
What it does	• Bring the audience/the participants closer to the subject • Set everyone on the same level of attention • Creates a productive and innovative environment for ideation

	• Allows people to free their mind as the facilitator will catch the participant's unrestricted attention
Basic rules	• Actively change the mindset of the audience before starting a workshop / discussion. • Get the audience in a state of excitement that draws their attention. • Get the people on a same emotional level to reduce human distances. • Focus on the quality and simplicity of the ice-breaker: Determining which ice to break will determine the success of this tool. • Bring participants closer: Set aside cultural, hierarchical or professional differences in order to create a perfect working environment. • Emphasise interdependencies between the participants: This will allow gaining the participants trust and commitment. • It will need to create a common platform of thinking: Emphasise the feeling that every participant is a vital element to the group. • By emphasising this necessity, criticism will be undermined and eventually it will allow participants to free their mind.
Session conduct	• Takes place as an introduction to a workshop / discussion / presentation • The Ice Breaker can work through: – Laughter, amusement – Surprise, shock – Raised curiosity • It can be triggered by different means, like: – Visual (mood boards, etc.) – Verbal (e.g. presentation speech, etc.) – Intellectual (content of a message, structure of a thinking process, etc.) • The facilitator leads the session and manages the scope of the exercise. • The steps in a typical session are: – Facilitator suggests a topic which could "break the ice" – Participants will all have the chance to answer to the suggested topic – The session ends when each participant made a statement on the suggested topic – As the session ends the facilitator can conclude by connecting people's statements • Many techniques allow to implement this tool • Examples: The Human Web, True or False

Preparation	• Know you audience well, in order to:
	  – avoid overachieving your effect
	  – ensures that everybody is receptive
	• Make sure the ice breaker doesn't expand for a too long time. Switch rapidly to main topic.
	• You can prepare other ice breakers spots to be used in the middle of a session
	• Suggest a topic, a question, etc.
	• The topic can also be provocative, to raise involvement
	• This topic must take into consideration the participants profile: every participant must be able to have an opinion on the topic

Limitations	• It can be difficult to find the right balance for your desired effect • It can be hard to anticipate the reaction of the audience • Mostly limited to introductory session
The Human Web	• Every participant must say a few words about himself / herself • A ball circulates among the participants, only the one having the ball is allowed to speak • Each participant hands the ball to a new participant when he finished introducing himself • When receiving the ball, each participant must start his introduction by quoting the last participant's speech, and linking the quote to his own presentation • The game forces the participants to build links between them, making them closer
True of False	• Every participant must say a few words about himself / herself • Inside his presentation, each participant must insert a false statement about him / her, without telling the audience which one it is • After a participant has spoken, the audience must get together find out which statement was false • The game helps the participants to really listen to what has been said, and take part in a group discussion

Ideation Tool	**Morphological Combinations** KSPG Automotive
What it does	• The system allows reducing the complexity of a problem. • It does it not by reducing the number of variables involved, but by reducing the number of possible solutions through the elimination of the illogical solution combinations in a grid box.
Basic rules	• Do brain storming regarding the parameters, the attributes etc. • Do not judge or evaluate them

	• Do not discard any idea
Session conduct	• Session conduct • Define parameters, attributes, options, etc. • Populate the matrix with possible solutions • Choose the best fitting solution per parameter • Connect them together See example on the right
Preparation	• Prepare matrix • Think about the attributes in advance • Define the team working on it
Limitations	• Time costing

Ideation Tool	**Vision Building**
What it does	• Sets a common goal in a more or less distant future and builds the steps to be taken backwards from the set vision to the present • Start from the target to finally reach the current situation
Basic rules	• Focus on visionary ideas. The ideal vision seems unrealistic today and describes a drastic change in present behaviour and technologies. • Think backwards. On the same principle as the child game "find the right path to the treasure", you gain efficiency if you start from the end.
Session conduct	• The facilitator leads the session by determining individually or with the participants the vision to set • Participants will create a backwards time framework which they can use to determine key steps in the development of the vision • Necessary cornerstones will be defined backwards, starting from the vision • Finally the facilitator will summarize the cornerstones and the mentioned drastic and unconventional ideas
Preparation	• The vision must be far enough in the future for the participants to disconnect from the current situation
Limitations	• Participants must agree on a vision before thinking backwards • Capacity to project oneself far enough into the future

Ideation Tool	**Concept Competition** KSPG Automotive
What it does	• Creates a competition between two teams working on the same topic • Simulates reality of company competition • Can be a teambuilding experience as well • Can be done "online" in a workshop session as well as "offline" during an extended duration • Can be done in-house by internal company teams as well as externally by e.g. university teams assigned by the company
Basic rules	• Transparency – like in every game the rules and criteria must be clear and transparent • Dimension – depending on layout give assignments that can be done within the time budget • Target/Goal – set clear goals concerning the result in terms of quality, quantity and form • Save – use the resources efficiently, consider alternative methods in advance
Session conduct	• Determine teams • Give a clear assignment including goals and big picture • Provide background information where necessary • Guide where necessary, give freedom to go and try new ways • Put proposals in a physical state e.g. by rapid prototyping methods
Preparation	• Gather relevant background information (e.g. state of the art, benchmarks, etc.) • Determine a clear timeframe and run a reality check with the assignment against this frame • Look for good coaches and experts inside and outside of the company to support efforts • Determine criteria for selection and assessment of solutions • Ensure commitment of support for background as well as solutions in the divisions
Limitations	• Participants must agree on a vision before thinking backwards • Capacity to project oneself far enough into the future

Ideation Tool	**Six Thinking Hats** KSPG Automotive
What it does	• Analyses a potential innovation • Fosters full-spectrum thinking for a better analysis • Provides individual assessment • Shifts emphasis away from judgmental thinking
Basic rules	• The six colours: White, Blue, Black, Yellow, Green and Red. • Each colour represents a mode of thinking and is a direction to think  White Hat: – Information hat – Facts and figures – Great to identify situation or gap – “Let’s look at the source of our data…”  Blue Hat: – Overview or process control hat – Deals with “Thinking about the subject” – Great to get group – “I feel we should do some more green hat thinking...”  Black Hat: – Critical viewpoint – Pessimistic – Useful to evaluate risk – "It won't work because...”  Yellow Hat: – Optimist’s viewpoint – Help visualise successful scenario – Useful to develop implementation plan, see where a solution will take you – “Great idea, we can… we will…”  Green Hat: – Creativity – Assumes that anything works – Great to generate new ideas – “Yeah, imagine that…”  Red Hat: – Intuition, feelings, emotional – What if you were a gut feel type of person – Great to get everybody’s opinion

	– "This doesn't smell good..." or "I really like the way this looks…" • Participants take time to think about the innovation while wearing each hat. • When done in a group everyone must wear the same colour hat at the same time.
Session conduct	• The workshop can be individual, or participants can be divided into groups of 5-6 people • The facilitator presents the idea to be assessed • Each group/participant picks one hat colour for the round • Each group/participant gathers around the flipchart corresponding to its hat • Duration of a round must be defined (e.g. 20 min) • During the round, each group / participant analysis the submitted idea at the light of their hat. Results are written on the flipchart • At the end of the round, each group / participant changes to another flipchart and a new round starts • At the end of the session, the facilitator gathers all flipcharts and the group agrees on a common synthesis
Limitations	• Some participants can be passive in the rounds which don't match their preferences, and start being active only when it reflects their mind • Group members may feel overwhelmed with too much data being generated

Ideation Tool	**Walt Disney Method** KSPG Automotive
What it does	• Lead creative processes to a success • The "Imagineering" process: to enable creative processes, to keep them up to the right pace and to execute them to finally reach success, you need people with different mindsets and sensibilities
Basic rules	• „If you can dream it, you can do it" (W. Disney) • Three different roles must be put in place: – Dreaming – Realising – Criticising
Session conduct	• 2 iterations, 10 minutes each step • 20 minutes preparation of debrief • Step 1: – The group is going to the "Dreaming-table" – Generate some ideas / visions

	– You do not have to be realistic, you must not restrict yourself • Step 2: – The group is going to the “Realising-table” – Ask “how will we realize this” (NOT “if” it is possible) – Do not look for constraints like budget, time etc. • Step 3: – With the results from step 1 & 2 in mind: Go to the “Criticism-table” – Look for constructive criticism – Check for roadblocks, potential problems, etc. • Step 4: – Based on the results from the first iteration start the whole cycle again – “with the given constraints, create a new vision / create new ideas – how the solution could look like – how can you do it – what are the constraints, etc.” – Stop when there is only minor new criticism
Preparation	• Have three tables ready for group discussion • The group sits together around one table • The problem is submitted to the group • The first task is "dreaming" the solution
Limitations	• Simplified version of the "Six Thinking Hats" method • Some people might find it difficult to focus their mindset in one direction on command

Résumé

Processus d'idéation de référence pour la phase amont de l'innovation

1 Motivation

L'obligation d'innover de plus en plus rapidement force les entreprises à adopter une approche systémique et efficace à la création d'innovations. Ces innovations concernent à la fois les produits, les services, et les modèles d'affaires, ainsi que les organisations et processus associés.

Le processus de la gestion de l'innovation comporte plusieurs étapes succinctes qui mènent de l'idée à sa commercialisation. Bien que la phase de création d'idées en fait la partie essentielle, elle est de loin la moins tangible et structurée. Par conséquence, sa nature créative, dynamique, incertaine et parfois ambigüe la rende difficile à intégrer dans les paysages des processus bien définis et structurés des entreprises occidentales modernes. Pourtant, le challenge principal qui se pose au management est d'arriver à capitaliser au maximum le potentiel de création et réalisation d'idées de toute l'organisation pour pouvoir nourrir « la machinerie de l'innovation ».

2 Problématique

De nombreux travaux des équipes membres des associations CIRP, Design Society, et EMIRAcle sur la conception intégrée de produits et de services ont démontré l'importance de la phase amont du processus de développement [RIE2009b], [DRA2009], [TIC1998], [TIC2000]. C'est bien là où la complexité et le coût de l'implémentation d'une idée ou d'un concept sont déterminés. La phase « floue » de naissance et création des idées doit être aperçue comme la phase la plus en amont de tous les processus dans une entreprise : toute conception commence par la naissance et la concrétisation incrémentielle et évolutionnaire d'une ou plusieurs idées. L'application du principe de l'intégration des acteurs du cycle de vie aussi pendant cette phase, peu voire

pas pratiqué dans les organisations classiques, nous semble une nécessité évidente et est notre préoccupation principale depuis le début de nos travaux de recherche dans ce domaine.

D'un point de vue plus large, les opportunités clés qui se présentent au management et aux équipes sont les suivantes :

- faciliter l'impulsion d'idées,
- impliquer et intégrer les acteurs sources d'idées à l'intérieur et à l'extérieur de l'organisation,
- institutionnaliser l'idéation par un processus vécu par l'organisation entière,
- évaluer les idées selon de critères économiques, écologiques, et sociétaux,
- mettre en fonctionnement une culture organisationnelle et une stratégie qui facilitent la création d'idées.

L'objectif de nos travaux de recherché est de trouver une démarche orientée processus pour aider les entreprises de grande et moyen taille d'exploiter ces opportunités au mieux afin de réussir le défi d'augmenter la quantité et qualité d'idées qui se transforment en innovations [STE1997], [DAN2007].

3 Contexte

Nous avons mené cette recherche en collaboration très étroite avec l'industrie, et plus particulièrement avec l'entreprise allemande KSPG AG, la société mère du secteur automobile du groupe Rheinmetall AG. En ligne avec sa stratégie, le groupe dispose de trois divisions: pièces mécaniques, mécatronique et services pour le moteur. Il emploie quelques 11.500 personnes dans ses sites de production en Europe, Amérique du Nord, Amérique du Sud et de la Chine.

Nous considérons dans le secteur automobile le terrain idéal pour nos recherches car ce secteur est mondialement reconnu comme le plus exigeant par rapport à la nécessité et la difficulté d'innover de manière à la fois rapide et solide. Le marché est caractérisé par des utilisateurs de plus en plus exigeants, des technologies hautement pointues, des législations de plus en plus strictes, des besoins de sécurité fortement croissants, des marges des produits fortement décroissants. De plus, les entreprises du secteur automobile font un exemple type des organisations pilotées par les processus minutieusement bien définis et structurés.

Au départ de nos travaux, les plus hauts responsables de la R&D déploraient « la sous-exploitation drastique du potentiel de créativité de leurs employés, et

un manque de nouvelles bonnes idées pour les produits ». Notre analyse révélait effectivement que la plupart des idées pour les produits existants avaient été apportées par les ingénieurs mêmes du produit. En outre, il n'y avait aucune démarche active pour faire que les employés réfléchissent aux innovations et les inciter à contribuer à l'innovation avec leurs propres idées [NEU2011a].

Cette situation, pourtant bien typique pour le secteur selon l'étude « Car Innovation 2015 » [DAN2007], représente une menace importante de stagnation des idées. C'est pourquoi, le management de KSPG avait lancé un projet stratégique pour la création et l'implémentation d'un processus d'idéation, commençant avec nos travaux.

Les fabricants d'automobiles ont clairement déclaré l'innovation de produits, services, et modèles d'affaires comme sujet clé pour augmenter leur compétitivité et se différentier sur le long terme [ILI2009]. Par conséquence, ils sont constamment en train de lancer des nouvelles initiatives de recherche et développement avancé afin de pouvoir innover de plus en plus vite, tout en respectant les contraintes budgétaires, législatives, qualitatives, etc., celles-ci eux-mêmes devenant de plus en plus nombreuses et strictes.

Vu que 90% des innovations dans l'automobile concernent le domaine électrique/électronique et logiciel, et que le marché demande de nouveaux services plus ou moins directement associés à l'automobile, ces initiatives doivent être portées par des équipes hautement pluridisciplinaires, ce qui pose de nombreux nouveaux défis aux organisations [GER2011], [GER2012a], [GER2012b], ainsi qu'aux outils de gestion de connaissances et d'informations [KIR2003]. Ceci a amené les fabricants à transférer une grande partie de responsabilité du développement des sous-systèmes aux sous-traitants, ceux-ci étant plus agiles et efficaces dans l'application de leurs compétences pointues en général. Or, ce transfert implique aussi la transmission directe de la pression sur la force d'innovation, le prix, la réactivité aux besoins du marché, etc. vers les sous-traitants. Ces derniers sont donc amenés non seulement à augmenter leurs investissements en recherche et développement, mais également à adapter leurs organisations et processus à cette situation dans laquelle les fabricants agissent comme clients très exigeants et intégrateurs des systèmes complets [KUR2004]. Ils sont effectivement censés d'anticiper et influencer les tendances et innovations eux-mêmes, plutôt que d'être pilotés par les fabricants.

Dans ce contexte hautement compétitif, les fabricants ainsi que les sous-traitants automobiles sont obligés de gérer l'innovation de manière proactive plutôt que réactive [BAR2008]. Pendant très longtemps dans ce secteur, la gestion de l'innovation s'est limitée à la création, évaluation, et au brevetage des idées pour des solutions techniques répondant à des problèmes connus.

Même aujourd'hui, la performance en innovation d'une entreprise automobile est toujours mesurée au nombre des brevets déposés par cette entreprise annuellement. Or, cette mesure ne prend pas en compte le succès de l'implémentation de toutes ces inventions sur le marché par rapport aux facteurs clés du temps (conception, réalisation et fabrication, introduction sur le marché, durée de vie, etc.), du coût (développement, coût global de possession – TCO, etc.), de l'impact sur l'environnement (impact écologique, économique, social), et autres. Par conséquence, elle n'est pas la bonne mesure pour évaluer la performance d'innovation effective.

Pour faire face à ces nombreux nouveaux défis, les entreprises du secteur automobile ont mis en place des processus opérationnels hautement interconnectés. Sur cette base, elles sont en train d'adopter des nouvelles formes de gestion de l'innovation [ILI2010b]. L'intégration systématique des nombreux acteurs qui interviennent tout au long du cycle de vie du produit dans les processus de l'innovation est très prometteuse [NEU2011d]. L'enquête menée par Ili et al. a démontré que l'adoption de l'innovation ouverte par l'industrie automobile sera un facteur hautement compétitif dans les dix prochaines années [ILI2010a]. Or, l'une des plus grandes difficultés du processus de gestion de l'innovation reste l'organisation de la phase floue amont (« fuzzy front-end »), en particulier le développement d'un processus pour la génération d'idées [NEU2011a].

4 Positionnement de la problématique

4.1 La gestion de l'innovation

La figure 1 montre notre démarche. Dans un premier temps, nous avons investigué la relation qui existe entre l'innovation, la gestion de l'innovation, et les idées. Dans la littérature il y a de nombreuses définitions du terme innovation, suivant les différents points de vue (économique, technique, etc.). Pourtant, à la clé de toutes ces définitions se trouve le fait qu'il y ait une idée à l'origine de toute innovation. Une idée ou plusieurs qui puissent être transformées en produit et/ou service qui apporte(nt) de la valeur à un marché cible. La vue économique ajoute à cela le succès économique qui porte sur la valeur qui puisse être vendue. Selon l'une des études européennes les plus importantes [ENG2010], la gestion de l'innovation est la capacité de gérer les idées pour de nouveaux produits et services, processus, méthodes de production, organisations, ou d'améliorations élémentaires de modèles d'affaires, y compris leur réalisation avec succès. Le succès se définit dans le contexte économique par des gains durables et de la croissance profitable.

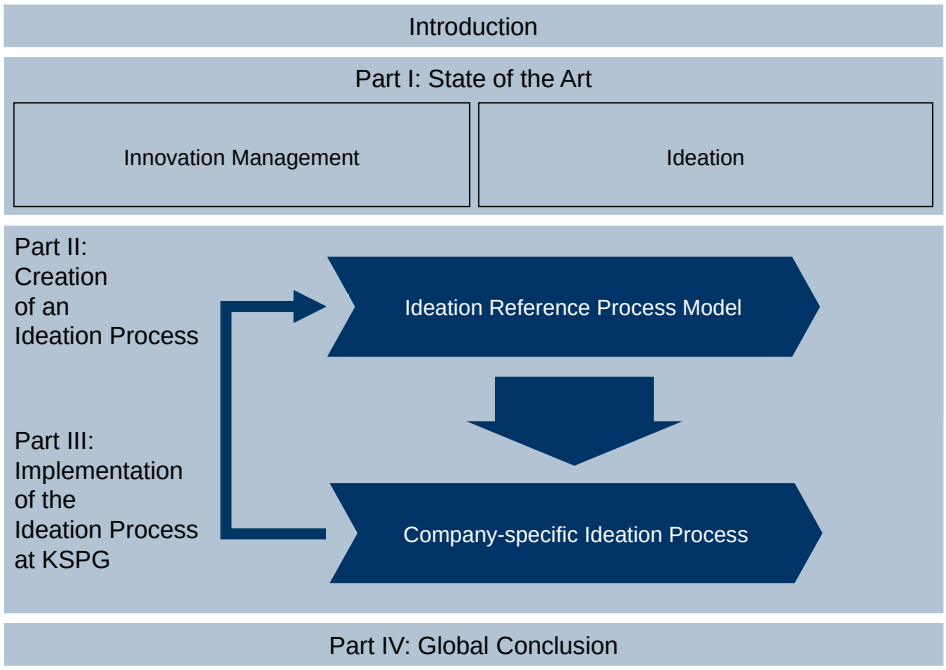

Figure 1 : La démarche globale de recherche pour l'idéation

Selon [SCH2005] le succès d'une innovation peut se mesurer en plusieurs dimensions, celles-ci permettant de distinguer les différents types d'innovation [HAU2011] :

1) Dimension du contenu : quelle est la nouveauté de l'innovation ?
2) Dimension de subjectivité : pour qui l'innovation est nouvelle ?
3) Dimension de processus : où sont le début et la fin de l'innovation ?
4) Dimension normative : est-ce que la nouveauté implique le succès ?

Grâce à ces définitions, il est possible de classifier les idées par rapport aux types d'innovation qu'elles déclencheront :

- L'innovation incrémentielle versus l'innovation radicale,
- L'innovation d'un produit, service, ou modèle d'affaires,
- etc.

Dans le contexte de notre projet de recherche, nous nous intéressons plus particulièrement à la dimension du processus. Chaque innovation est le résultat de nombreuses activités liées par leur contenu [VAH1999], celles-ci peuvent se dérouler en séquence et/ou en parallèle, et elles peuvent également être répétées si c'est nécessaire [HAU2011]. Elles couvrent toutes les phases dès la

naissance d'idée jusqu'à sa réalisation et son usage. Dans la littérature, il n'y pas de consensus sur le nombre et la définition de ces différentes phases [THO1980], [KLE1996] and [BRE2007].

Le modèle proposé par Thom [THO1980] est particulièrement intéressant pour nous car il met l'idée au centre de ses investigations, et définit des phases principales du processus d'innovation autour de cette idée (tableau 1).

Stages of the innovation process		
Main stages		
1. Idea Generation	2. Idea Acceptance	3. Idea Realisation
Specification of the Main Stages		
1.1 Determination of search field	2.1 Testing ideas	3.1 Actual realisation of the new idea
1.2 Finding ideas	2.2 Creation of realisation plans	3.2 Sale of the new idea to the addressee
1.3 Idea suggestion	2.3 Decision to realise a plan	3.3 Acceptance control

Tableau 1 : Le modèle du processus de l'innovation selon Thom ([THO1980] et [BRE2007])

Un modèle beaucoup plus récent et très souvent cité est celui publié par Hansen et Birkinshaw [HAN2007]. Alors qu'il est en parfait accord avec le modèle de Thom, il étend ce dernier au-delà de la réalisation d'idée jusqu'à sa capitalisation, ainsi donnant la notion de création de valeur à l'évolution d'une idée. Par conséquence, les créateurs appellent leur modèle « la chaine de valeur d'idées » (Idea Value Chain).

La figure 2 montre cette chaine de valeur d'idées, composée de trois phases principales: la génération, la conversion, et la diffusion d'idées.

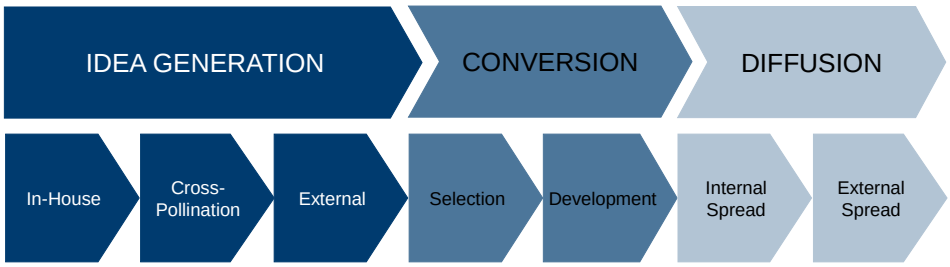

Figure 2 : La chaine de valeur d'idées [HAN2007]

Les idées peuvent être générées dans (« in-house ») ou en dehors de l'organisation (« external »); la « cross-pollinisation » vise à faire collaborer les différentes unités et divisions pour intégrer et valoriser leur connaissance.

L'étape de conversion comprend la sélection et le développement d'idées. La sélection signifie l'analyse d'idées et l'initiation de leur financement. L'étape du développement transforme les idées sélectionnées pour un financement en produit. L'étape de diffusion sert à diffuser les idées à travers l'organisation pour qu'elles puissent être valorisées.

Des indicateurs doivent être spécifiés pour mesurer la performance de ces étapes succinctes. Ceci est indispensable car « la capacité d'une entreprise à innover n'est aussi bonne que le lien le plus faible de sa chaine de valeur d'innovation » [HAN2007]. Tout lien faible non-identifié et non-remédié peut casser cette chaine et ainsi nuire à la performance d'innovation de l'entreprise.

Ce modèle de chaine de valeur permet de formuler des recommandations pour des actions pratiques d'amélioration, comme par exemple:

- Remédier aux faiblesses en génération d'idées, notamment par la construction des réseaux externes et/ou inter-unités.
- Remédier aux faiblesses en conversion d'idées par le financement inter-unités et la création des « havres protectrices ».
- Faciliter la diffusion d'idées par des « évangélistes d'idées ».

Hansen et Birkinshaw soulignent qu'il n'y avait pas de solution unique pour aider les entreprises à améliorer la performance de leur chaine de valeur d'idées, et que l'imitation des meilleures pratiques n'était pas le bon chemin à prendre. Chaque entreprise a des défis d'innovation particuliers, et les pratiques qui sont les meilleures dans une entreprise peuvent être les plus mauvaises dans une autre. Par conséquence, le management doit avoir un regard sur l'intégralité de la chaine de valeur d'idées dans leur entreprise pour pouvoir identifier leurs points faibles spécifiques et ainsi adapter les meilleures pratiques à leurs besoins [AMM2008].

Le modèle de chaine de valeur d'idées permet donc de diagnostiquer, évaluer, et contrôler la performance d'innovation. Si nous nous intéressons en particulier à ce modèle, il faut bien prendre en compte que dans une entreprise donnée, cette chaine est embarquée dans un contexte plus large qui l'influence. Dans [ENG2010], les auteurs proposent un modèle cohérent et universel ayant servi de ligne directrice pour analyser et évaluer les processus d'innovation dans plus que 1.500 entreprises de petite ou moyenne taille (PMEs) en Europe. Ce modèle représente l'innovation en maison avec plusieurs étages construites sur la base des facteurs facilitant l'innovation, et s'appelle "A.T. Kearney House of Innovation", d'après l'entreprise de conseil en management mondiale qui l'a commercialisé (figure 3).

Figure 3 : La « maison de l'innovation » d'après A.T. Kearney [ENG2010]

Nous avons investigué tous les éléments constructifs de cette maison en [RIE2011]. Tout au long de notre parcours de recherche, ce modèle nous a bien servi pour nous rappeler des différents facteurs clés à prendre en compte lors de la conception d'un processus de référence pour la création d'idées.

4.2 L'intégration des acteurs

Sur la base de nombreux travaux sur la conception intégrée sur Grenoble et plusieurs laboratoires membres d'EMIRAcle, nous avons identifié l'intégration des acteurs d'expertises et de métiers différents dès les phases amont du processus de développement de produit comme facteur clé pour le développement durable [RIE2009b]. L'aspect de la durabilité se traduit par la possibilité d'identifier et intégrer les différents points de vue d'experts sous forme des besoins et contraintes au produit et son processus de développement dès le début de la conception [SAU2010]. Ces besoins et contraintes de natures économiques, écologiques, et sociales doivent être apportés au juste besoin [BRI2000] et prises en compte dans la conception et l'architecture du produit/système.

Pour notre recherche, nous projetons ce principe de l'intégration des acteurs également sur le processus de gestion de l'innovation, et plus particulièrement

sur la phase de création et évaluation d'idées. Ceci nous semble évident, étant donné qu'il s'agit effectivement de la phase « racine » de tout processus de développement de voir le cycle de vie du produit/système. Cette réflexion nous amène à l'innovation ouverte, un concept moderne et récemment introduit par Chesbrough [CHE2003] en 2003, et origine de « Coopetition » [BEN2000]. Elle joue également un rôle essentiel dans la théorie de la conception innovante C-K (« Concept – Knowledge ») marquée par Hatchuel et Weil [HAT2003], ainsi que dans son application à la création de la capacité d'idéation et d'innovation dans une organisation [HAT2006].

Dans [NEU2011a] et [NEU2011c] nous avons mené une réflexion concernant les différents « mondes » regroupant les groupes d'acteurs qui se ressemblent par rapport aux trois principes sociaux proposés par [MER1997] dans le contexte de la conception intégrée de produits : la logique d'action, l'échelle de valeur, et la connaissance collective. Cette réflexion est nécessaire car il faut trouver les bons moyens et outils pour pouvoir intégrer chaque monde d'acteurs dans le processus d'innovation de manière efficace et durable [ELI2002], [ROU2003], [STE2009]. Ceci implique de se poser les questions suivantes :

- Qui sont les acteurs à impliquer dans la gestion d'innovation?
- Quels sont leurs intérêts et leurs échelles de valeur?
- Quels sont les rôles des acteurs, et comment s'évalue leur influence?
- Quelles interactions, dépendances et/ou conflits existent entre les acteurs? Quels sont les facteurs clés de succès pour les impliquer ?
- Quels méthodes et outils doivent être appliqués pour faciliter l'intégration des acteurs dans la gestion de l'innovation de manière efficace et durable?

Les acteurs internes de l'organisation – les employées pour la plupart – représentent les sources d'idées les plus citées [STA1992], [BEL2004], [ALA2003]. Or, nous nous intéressons aussi à l'implication des acteurs externes dans le processus d'innovation, suivant le principe de l'innovation ouverte.

4.3 L'idéation

L'idéation (« ideation » en anglais) signifie « le processus de génération des idées créatives » [MAH2011]. Vue l'importance essentielle de ce terme dans le contexte de notre recherche, nous l'avons redéfini de manière plus précise :

> ***L'idéation signifie la procédure de la génération d'idées et la sélection d'innovations de nouveaux produits, modèles d'affaires où services ayant un potentiel commercial sur le marché.***

Cette définition exclut volontairement les idées pour l'amélioration des processus de l'entreprise en se focalisant uniquement sur les idées basées sur les innovations pour le marché. Ceci est très utile, car il permet de délimiter notre domaine de recherche de celui qui s'adresse à la gestion des idées, activité qui aujourd'hui s'adresse très souvent uniquement aux systèmes de suggestions pour l'amélioration continue (Kaizen) [IMA1997], [KOS2011], [BIS2008] et [THO2009]. Contrairement aux systèmes facilitant l'idéation en notre sens, ces systèmes ont déjà une longue histoire en Europe, Amérique, et Asie, et sont déjà bien établis, ainsi que les outils informatiques associés [LLO1999]. En outre, le terme idéation tel que nous l'avons défini, a été utilisé dans le même sens dans le contexte de la conception intégrée, et plus particulièrement par « l'école américaine » avec le « Design Thinking », marquée notamment par le filiale essaimée de l'Université de Stanford, CA IDEO [KEL2004], [BRO2008], [BRO2009].

Pour situer l'idéation dans le processus d'innovation, nous adoptons la vue établie par Koen et al., dans laquelle le processus d'innovation se compose de trois parties succinctes [KOE2001] :

1) la phase floue amont (« fuzzy front-end », FFE),
2) le processus de développement de nouveaux produits (« New Product Development », NPD) et
3) la phase de commercialisation.

Le FFE est donc la somme de toutes les activités en amont du NPD, ce dernier étant en général bien structuré, typiquement formalisé en points de décision [KOE2002] et [COO2011]. NPD est aussi exhaustivement traité dans la littérature. Une synthèse de référence est [ERN2002].

Le point de transition entre le FFE et le NPD est en général marqué par la décision de la direction pour ou contre le projet, d'où ce point s'appelle souvent le « money gate » (point de décision financière) [ZHA2001], [HER2007b].

Vu que l'idéation est par définition la toute première phase de ce processus [BUL2008], et que la phase de FFE comporte toutes les phases avant la transition d'un concept concret vers l'NPD, il devient possible de situer l'idéation dans le modèle de Koen (figure 4).

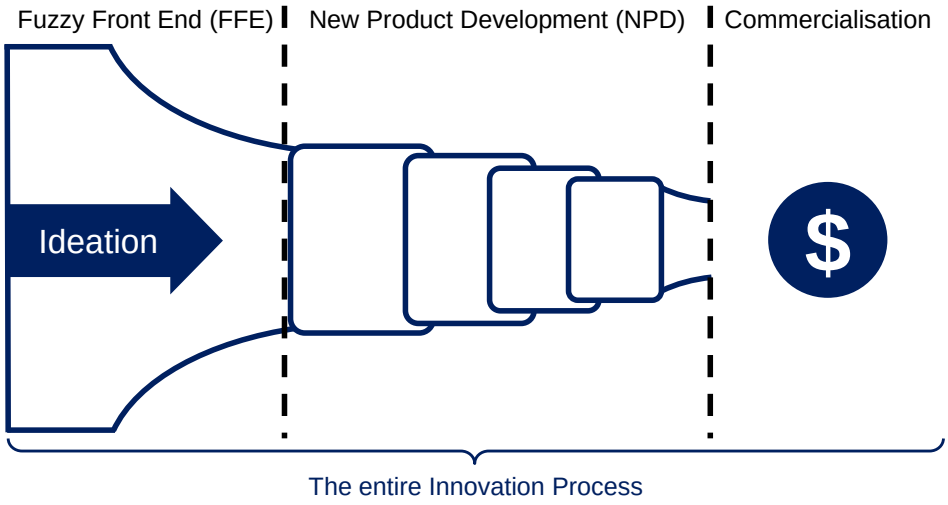

Figure 4 : Le processus de l'innovation d'après [KOE2002]

Pour pouvoir situer la fin de la phase d'idéation dans le FFE plus précisément, nous avons choisi l'un des modèles du FFE les plus cités dans la littérature de recherche en ingénierie de produits, celui de Khurana et Rosenthal [KHU1997] (figure 5).

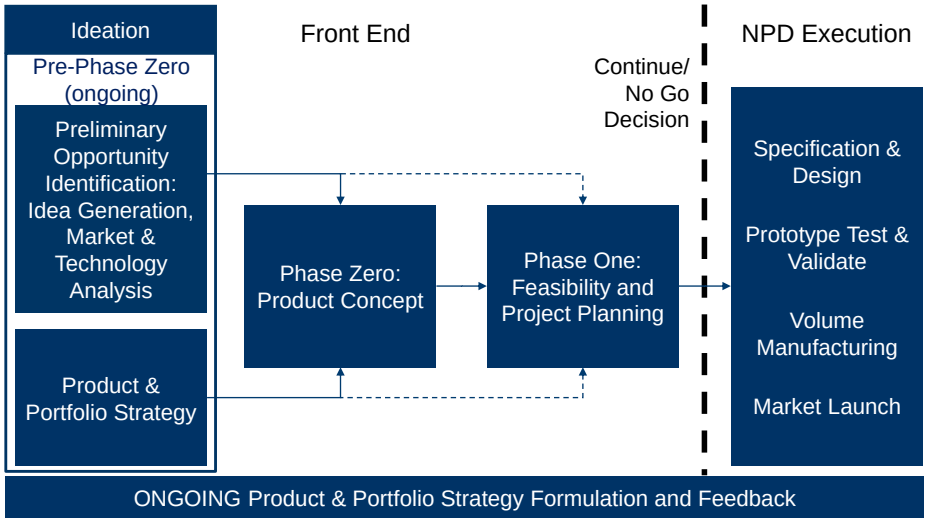

Figure 5 : Le modèle pour la phase floue amont d'après Khurana et Rosenthal (basé sur [KHU1998])

Dans ce modèle, notre vue de la phase d'idéation correspond à la « Pre-Phase Zéro », et ne comprend ni la création d'un concept de produit (Phase Zéro), ni la planification du projet NPD. Khurana et Rosenthal soulignent que

l'organisation, la culture, la stratégie et d'autres facteurs de l'environnement dans lequel le processus d'innovation se déroule, jouent un rôle très important pour le succès des activités du FFE. Ceci est en parfait accord avec l'objectif clé de notre recherche, ainsi qu'avec le concept de la maison d'innovation selon A.T. Kearney, introduite précédemment.

5 Questions clés de recherche

La délimitation et cette positionnement du terme « idéation » a été un pas essentiellement important pour notre recherche, car il nous a permis de nous focaliser sur la tâche pour avancer là où il y a encore un véritable vide dans les résultats de recherche publiés : *comment mettre l'idéation dans un processus structuré qui la rende gérable, sans nuire à la créativité et à la dynamique qui lui est intrinsèque* ?

Sont associées à cette question principale de recherche les sous-questions suivantes :

1) D'ou viennent les nouvelles idées?
2) Quelles sources internes et externes sont particulièrement pertinentes à l'idéation?
3) Quelle culture organisationnelle facilite l'idéation ?
4) Est-il possible de mesurer le succès d'idées, et comment?
5) Comment les entreprises du secteur automobile et d'autres secteurs font-elles pour structure leur processus d'idéation?
6) Quelles meilleures pratiques en gestion d'idéation existent?
7) Quelles expériences doivent être prises en compte lors de la création et implémentation du processus d'idéation?
8) Quelles interfaces et responsabilités sont nécessaires pour la génération et sélection d'idées?
9) Quels autres processus, méthodes et systèmes sont connectés avec le processus d'idéation (processus de prise de décision, voies de communication, idées refusées, etc.)?

Afin de pouvoir répondre à ces questions pratiques et théoriques qui se posent dans le contexte de notre recherche, nous avons choisi une démarche basée sur la théorie fondée sur la recherche documentaire et des entrevues d'experts et sa validation dans un environnement réel. La figure 6 visualise cette démarche.

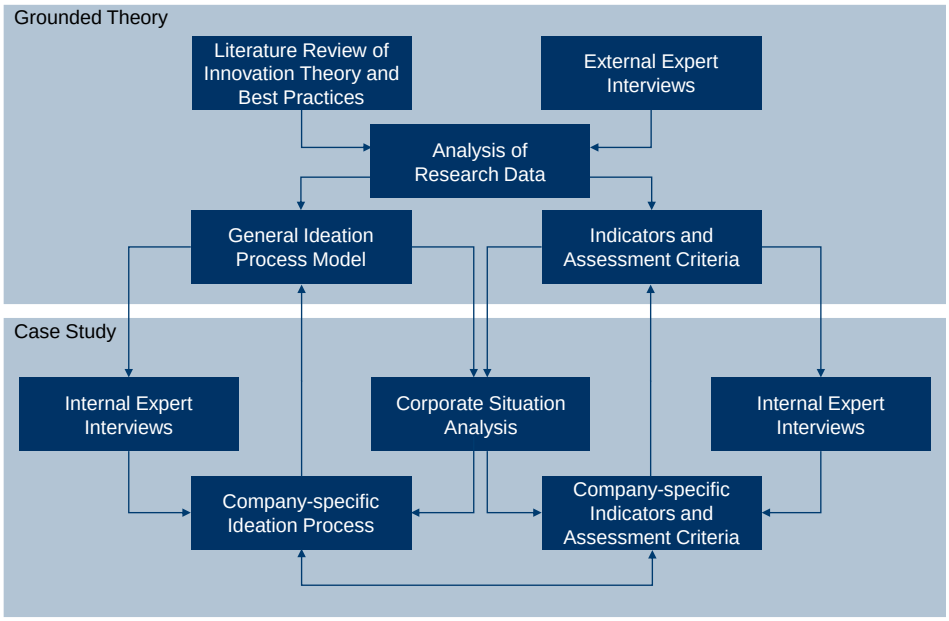

Figure 6 : Cadre conceptuel de recherche en idéation

En particulier, nous soulignons l'importance des entrevues d'experts externes et internes pour connaitre et comprendre les pratiques actuelles en idéation dans les entreprises du secteur automobile et autres. Nous avons constaté qu'il est impossible de trouver ces informations dans la littérature, car l'idéation telles que nous l'avons définie est un sujet assez jeune et surtout hautement compétitif et confidentiel pour un secteur où l'innovation « fermée » domine toujours sur le terrain.

6 Méthodologie de recherche

Les questions de recherche et le principe de l'approche étant bien définis, nous nous sommes posé la question de la meilleure méthodologie qui nous amènerait d'abord à la définition d'un processus d'idéation de référence à partir des résultats de recherche issus de la littérature et des entrevues d'experts, ensuite à la spécification d'un processus spécifique pour l'entreprise sous investigation.

Il était évident qu'il ne fallait pas simplement appliquer un processus vécu dans une entreprise dans une autre. Les bonnes pratiques d'une organisation ne sont pas forcément bonnes dans une autre, car le contexte change : les acteurs, leur environnement, leur culture, leurs besoins et contraintes, etc. Au lieu de cela, nous avons décidé d'adopter une démarche courante en mathématique pour trouver une ou la solution d'un problème qui est difficilement à résoudre dans

un espace donné : la transformation du problème dans un autre espace ou sa résolution est plus facile, puis la re-transformation de la solution dans l'espace d'origine. Dans notre contexte de recherche particulier cette démarche se traduit par les étapes suivantes :

1) L'identification et l'analyse des bonnes pratiques de l'idéation dans une sélection d'entreprises (espace « entreprise »).
2) La dérivation des facteurs clés du succès des bonnes pratiques identifiées (espace facteurs de succès, indépendant d'entreprise).
3) La mise en contexte des facteurs clés dans une entreprise cible donnée (espace « entreprise »).

Cette démarche de « re-contextualisation » de la connaissance via un espace « neutre » est démontrée en figure 7. Cette figure représente notre véritable feuille de route de notre recherche et par conséquence détermine également la structure des sections suivantes de ce manuscrit.

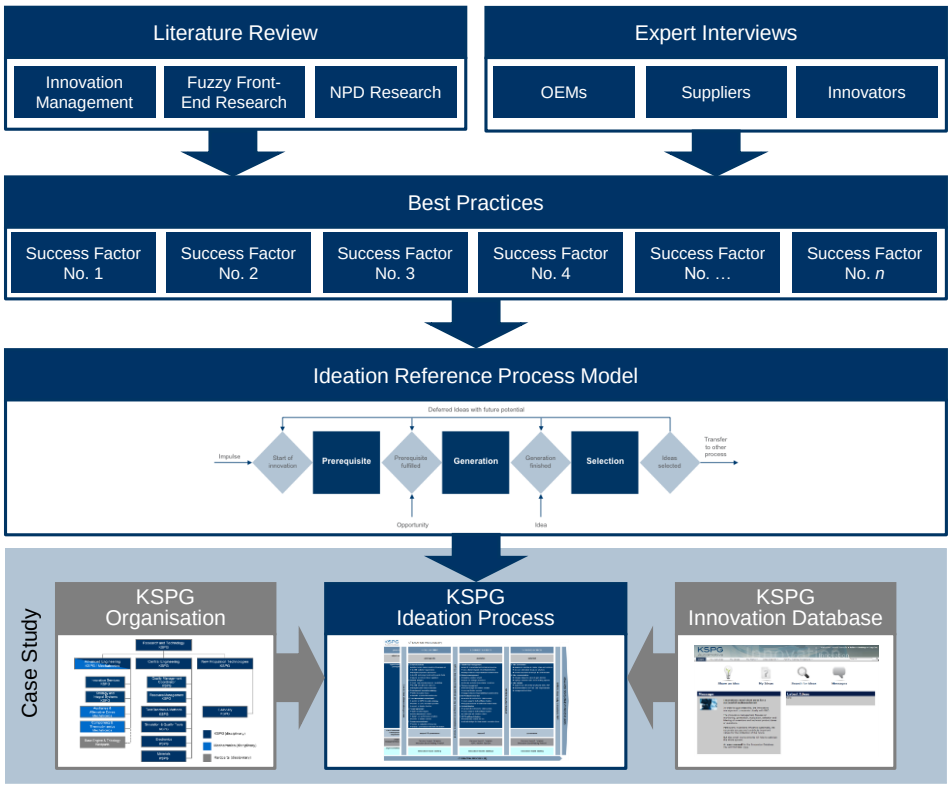

Figure 7 : Méthodologie de recherche

7 Résultats de recherche

7.1 Recherche documentaire

Quant à la recherche dans la littérature, nous avons suivi une approche très systématique pour faire face à la pluridisciplinarité de notre sujet qui touche aux trois disciplines suivantes :

1) les sciences sociales,
2) les sciences économiques,
3) les sciences de l'ingénieur.

Cette démarche est montrée en figure 8.

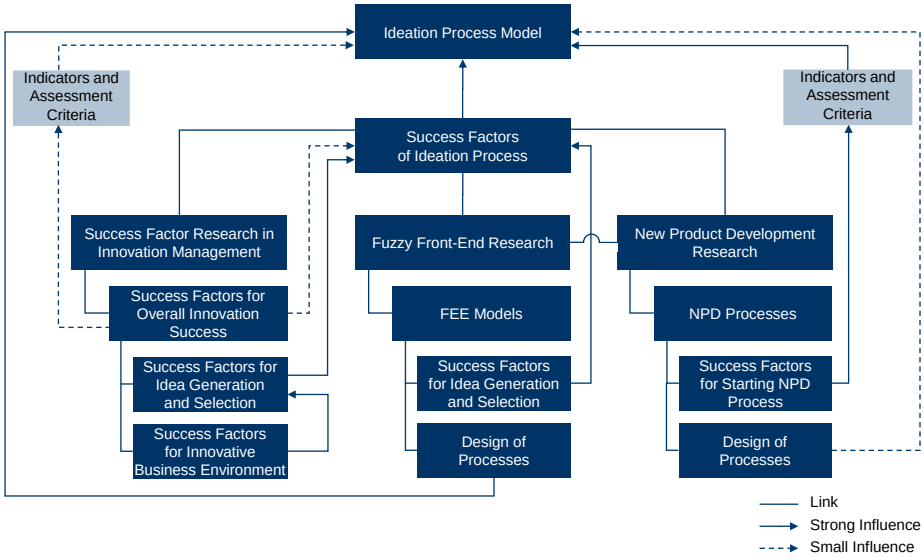

Figure 8 : Concept systématique pour la recherche documentaire

En synthèse, cette recherche a donné les résultats suivants :

1) Dans le contexte d'idéation, les sciences sociales s'occupent notamment de la créativité des individus et des groupes, sujet qui n'est pas notre première priorité. Nous nous occupons de la mise en valeur de la créativité des individus d'une organisation étendue pour un objectif particulier.
2) Les sciences économiques s'occupent du succès économique des innovations, sans remonter à l'origine de celles-ci.

3) Dans les sciences d'ingénieur, il y a une quantité importante des travaux sur le sujet NPD avec des résultats très intéressants pour nous. Vu que le processus d'idéation précède le NPD l'on peut le considérer comme étape préparatrice de ce dernier. Par conséquence, toute mesure prise dans le processus d'idéation qui sert à influencer les facteurs de succès du NPD de manière positive, contribue aux facteurs de succès du processus d'idéation.

Khurana, Rosenthal et Ernst ont établi la référence des facteurs clés du succès du NPD avec leurs publications [KHU1998] et [ERN2002]. Elles nous ont servies comme source principale pour la dérivation de facteurs clés de succès d'idéation à partir des résultats de recherche en NPD.

7.2 Entrevues d'experts

Par manque d'informations publiées sur les bonnes pratiques d'idéation, nous avons mené une série d'entrevues d'experts grâce au support de l'entreprise de conseil, celle-ci possédant des contacts clés parmi les experts en innovation chez la plupart des entreprises que nous avons choisies. Le tableau 2 donne une vue ensemble de ces entreprises pour lesquelles nous n'avons pas l'autorisation de mentionner les noms pour des raisons de confidentialité.

Target Group	Scope	Reason for sampling	Data collection procedures	Companies
1	German automotive OEMs	• German automotive industry is regarded as innovation leader in the industry • Access available to interview participants or secondary data	• Interviews • Analyses of various publications from relevant congresses	• OEM 1 • OEM 2 • OEM 3 • OEM 4
2	Successful German automotive suppliers (Tier 1 supplier)	• The case study's company belongs to this segment • Comparison is interesting and necessary	• Interviews • Analyses of various publications from relevant congresses	• Supplier 1 • Supplier 2 • Supplier 3

3	Worldwide recognised innovation leaders, non-sector-specific	• Inspiration from interdisciplinary perspectives on other industries	• Interviews • Analyses of various publications from relevant congresses	• Innovator 1 • Innovator 2 • Innovator 3 • Innovator 4 • Innovator 5 • Innovator 6

Tableau 2 : Enquête par des entrevues d'experts externes

Toutes ces entrevues ont été menées par les membres de l'équipe de recherche avec le support d'un questionnaire complémenté par un guide détaillé. Elles ont été transcrites de manière séparée afin d'assurer la fiabilité « inter-rater » [ARM1997]. Les résultats ont été compilés dans un rapport, analysés et consolidés lors de deux ateliers d'équipe. Vue la nature qualitative de cette activité nous avons fait une synthèse qui nous avons incluse dans la spécification du processus d'idéation.

7.3 Les six facteurs clefs du succès de l'idéation

Ici nous nous limitons à la présentation des facteurs clés du succès que nous avons ainsi identifié, ceux-ci étant les éléments essentiels pour la conception du processus d'idéation.

1) Facteur clé de succès no. 1 (S1):

   L'idéation commence au top management.

   L'appel et la profession de foi de la part du top management pour l'idéation sont essentiels et doivent être clairement visibles et compréhensibles par tous les employés.

2) Facteur clé de succès no. 2 (S2):

   L'idéation demande une focalisation clairement définie et communiquée.

   L'analyse systémique et systématique de la situation globale de l'entreprise et sa stratégie est nécessaire pour identifier les champs d'action d'idéation qui ensuite doivent être communiqués à travers de l'organisation entière.

3) Facteur clé de succès no. 3 (S3):

   L'idéation se fait en réseau.

   L'intégration des acteurs internes et externes évite les innovations de type "moi aussi" et augmente le potentiel d'innovation.

4) Facteur clé de succès no. 4 (S4):

L'idéation demande de la créativité.

La promotion de la créativité et son intégration dans les processus d'entreprise augmente la qualité et la quantité des idées.

5) Facteur clé de succès no. 5 (S5):

L'idéation a besoin d'esprit d'entrepreneur.

Déclencher et pousser la compétition portant sur les idées et leur marketing dans l'entreprise augmente le niveau de maturité des idées et leur qualité.

6) Facteur clé de succès no. 6 (S6):

L'Idéation a besoin d'orientation organisationnelle-

Les processus ciblés avec des critères d'évaluation clairs et précis facilitent la communication et la conversion des idées.

Tous ces facteurs contribuent à la base à la création d'une culture d'innovation ouverte qui facilite l'intégration de nombreux acteurs dans le processus d'idéation permettant ainsi de valoriser leurs observations, expériences, expertises, et créativité.

7.4 Le processus d'idéation de référence

L'un des modèles de processus les plus établis dans l'industrie [COO1990], [COO1991], [RUN2002] et [WHI1998] est le modèle « étape – points de décision » (« stage-gate » en anglais) par Cooper [COO2011]. Il est implémenté dans toutes les entreprises du secteur automobile en Europe, mais aussi chez 3M, Procter & Gamble, Hewlett Packard [VER2007b] et beaucoup d'autres. La caractéristique principale de ce modèle est sa composition de plusieurs étapes multifonctionnelles dont chaque une est suivie par un point de décision décidant de la transition vers la prochaine étape.

Notre objectif principal pour la modélisation du processus d'idéation de référence était d'arriver à une projection claire et simple des six facteurs clés identifiés pour chaque étape et point de décision de manière que chacun de ces facteurs puisse être implémenté dans toute l'organisation spécifique. A ce but, nous avons conçu le processus affiché en figure 9.

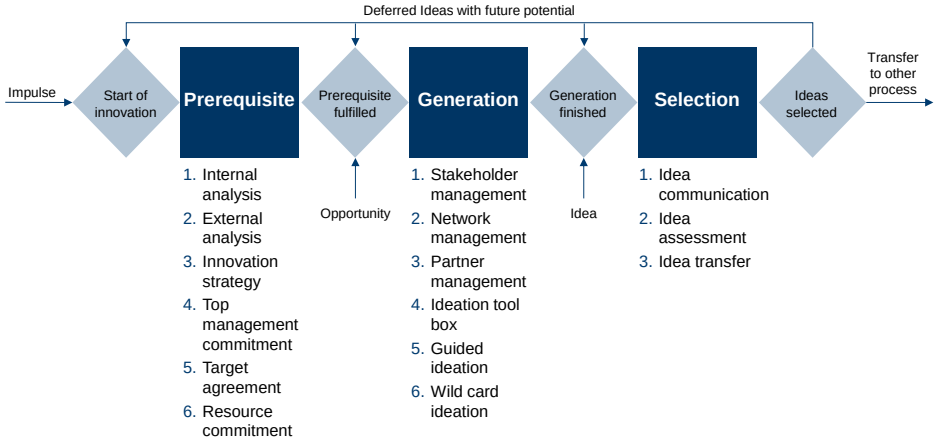

Figure 9 : Processus d'idéation de référence

Le tableau 3 montre les tâches à achever dans chaque étape, ainsi que la correspondance avec les facteurs clés de succès.

Ideation Process Phase	Ideation Activities	Success Factors
Prerequisite	Internal Analysis	S1 and S2
	External Analysis	
	Innovation Strategies	
	Top Management Commitment	
	Target Agreement	
	Resource Commitment	
Generation	Stakeholder Management	S3 and S4
	Network Management	
	Partner Management	
	Ideation Tool Box	
	Guided Ideation	
	Wild Card Ideation	
Selection	Idea Communication	S5 and S6
	Idea Assessment	
	Idea Transfer	

Tableau 3 : Correspondance des facteurs clés de succès avec les étapes du processus de référence d'idéation

La première étape, dédiée à la mise en place des conditions préalables pour l'idéation, contient beaucoup de tâches basées sur des activités qui se font dans le cadre du management stratégique de toute entreprise. Par conséquence, l'effort pour les implémenter est considérablement réduit. La deuxième étape

est intégralement consacrée à faciliter au maximum la création d'idées en réseau d'acteurs internes et externes. Grâce à l'idéation « joker » (« Wild Card Ideation » en figure 9) il devient possible pour les acteurs d'introduire des idées exceptionnelles, voire révolutionnaires, qui sortent des contraintes imposées par l'étape d'avant dans le processus, tenant ainsi compte de la spontanéité intrinsèque de l'objet cible du processus.

Nous rappelons également que ce processus de référence ne comporte aucun élément qui est véritablement spécifique au secteur automobile.

7.5 Implémentation et validation du processus chez KSPG

Notre objectif est de valider notre processus d'idéation de référence dans plusieurs entreprises de différents secteurs industriels. Le contexte de cette thèse nous a permis de faire une première validation chez le sous-traitant automobile KSPG.

Vue la nature hautement compétitive et stratégique transformant la culture d'innovation de l'entreprise, chaque projet de validation est

- sujet à de longues négociations avec le top management,
- un projet qui nécessite des investissements financiers à travers l'organisation entière,
- un projet dont les effets ne sont visibles et évaluables que sur le moyen voire longue terme,
- un projet qui implique une très grande partie de l'organisation de l'entreprise,
- un processus de transformation de la culture organisationnelle de l'entreprise.

Tous ces facteurs rendent l'acquis, le lancement, et l'accompagnement d'un tel projet difficile et intensif en investissement de temps et d'efforts. Par conséquence, il faut tirer un maximum d'expériences et d'inspirations de chaque projet pour pouvoir valider le processus.

Au départ du projet, le processus de gestion d'innovation actuel chez KSPG AG est lié au « KSPG Advanced Development Process » (ADP, processus de développement avancé), processus consacré au développement des nouveaux produits jusqu'au point où ces produits puissent être développés selon le « Product Development Process » (PDP, processus de développement de produits) spécifique à chaque division de l'entreprise. L'ADP ainsi que les PDP sont clairement définis selon le modèle étape – points de décision y compris les

outils correspondants. La gestion d'innovation est sous la responsabilité est sous la responsabilité d'un manager d'innovation, lui-même un employé du département Ingénierie Avancée de la division centrale Recherche et Technologie. Il est responsable de la collection, sélection, et évaluation des idées de produits et du démarrage d'ADP pour leur réalisation [RIE2009c] et [DRA2010].

Ce processus est en accord avec la « chaine de valeur d'idées » selon Hansen et Birkinshaw [HAN2007]. La figure 10 démontre la relation entre les différents processus chez KSPG AG, ainsi que leur correspondance avec la chaine de valeur d'innovation. Sont également indiqués les niveaux de maitrise des étapes et activités de la chaine, tels qu'ils étaient aperçus par le management au départ de notre projet. On peut constater sans aucune ambiguïté que la gestion de création d'idées de produits était considérée comme inexistante. Elle ne consistait que d'un appel annuel par email aux employés de la division R&D pour des propositions de nouveaux produits et d'améliorations des produits existants. Une base de données (« Innovation Database » en figure 10) servait à la collecte et la sélection des idées par un cercle fermé des managers de la division R&D, ce mode de sélection impliquant trop peu d'experts ce qui est également considéré comme un point faible qu'il fallait améliorer [BOO2011].

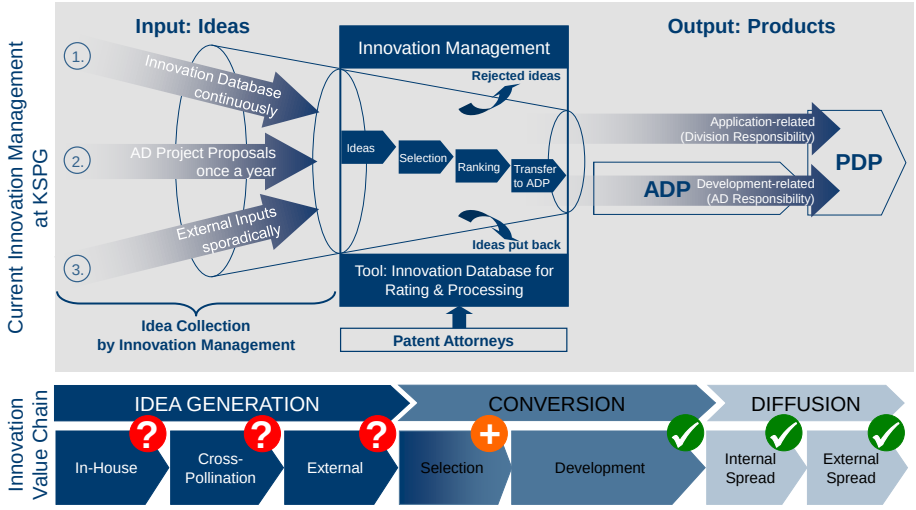

Figure 10 : Processus de gestion d'innovation actuel chez KSPG AG

La hiérarchie de la division R&D souhaitait donc structurer, gérer la génération d'idées et améliorer la sélection de ces dernières. C'est un cas d'étude parfait pour valider notre approche, en partant d'un processus de génération d'idées facilitant l'implémentation des facteurs clé de succès d'idéation dans une organisation spécifique donnée. Pour ce faire, notre approche doit parcourir les étapes suivantes :

1) Identification des champs d'action prioritaires par l'analyse du niveau d'implémentation de chaque facteur clé du succès d'idéation dans le processus actuellement existant chez l'entreprise.
2) Identification des éléments organisationnels de l'entreprise nécessaires pour réaliser chaque étape et point de décision du processus d'idéation de référence.
3) Conception d'une spécifique incarnation du processus d'idéation de référence qui prend en compte l'implémentation de
   a) tous les facteurs clés de succès d'idéation, ainsi que
   b) tous les champs d'action prioritaires identifiés en étape 1

   avec les éléments organisationnels identifiés en étape 2.
4) Démonstration de la faisabilité du nouveau processus.
5) Proposition d'un concept d'introduction du processus dans l'organisation existante.
6) Accompagnement du processus d'introduction, amélioration du processus de référence et du processus spécifique grâce au retour d'expérience.

Notre projet ayant commencé en mars 2012, nous avons au jour de la rédaction finale de ce manuscrit parcouru toutes les étapes 1 à 5 avec la grande satisfaction de la hiérarchie. Le démarrage de la dernière étape 6 est prévu en automne 2012.

Ici nous présentons en figure 11 la vue ensemble du processus tel que nous l'avons conçu et qu'il a été accepté par la hiérarchie de la division R&D de KSPG AG. Ce processus correspond exactement aux standards de représentation des processus dans l'entreprise, et précède désormais son processus ADP (figure 12). Chaque étape, action, et point de décision correspond à un ou plusieurs facteurs clés du succès, et/ou un champ d'action prioritaire identifié lors de l'étape 1. Conformément aux standards de qualité de l'entreprise, des documents et modèles ont été créés pour l'intégralité des réunions prévues, ainsi que la plupart des tâches et outils. La prise en compte des documents et processus existants dans l'entreprise fut un élément essentiel pour faciliter l'introduction du nouveau processus et la transformation de la culture d'idéation dans l'entreprise.

En parallèle, nous avons démontré la faisabilité de ce résultat en l'appliquant à petite échelle sur le sujet de la mobilité électrique, objet des investigations stratégiques importantes chez KSPG.

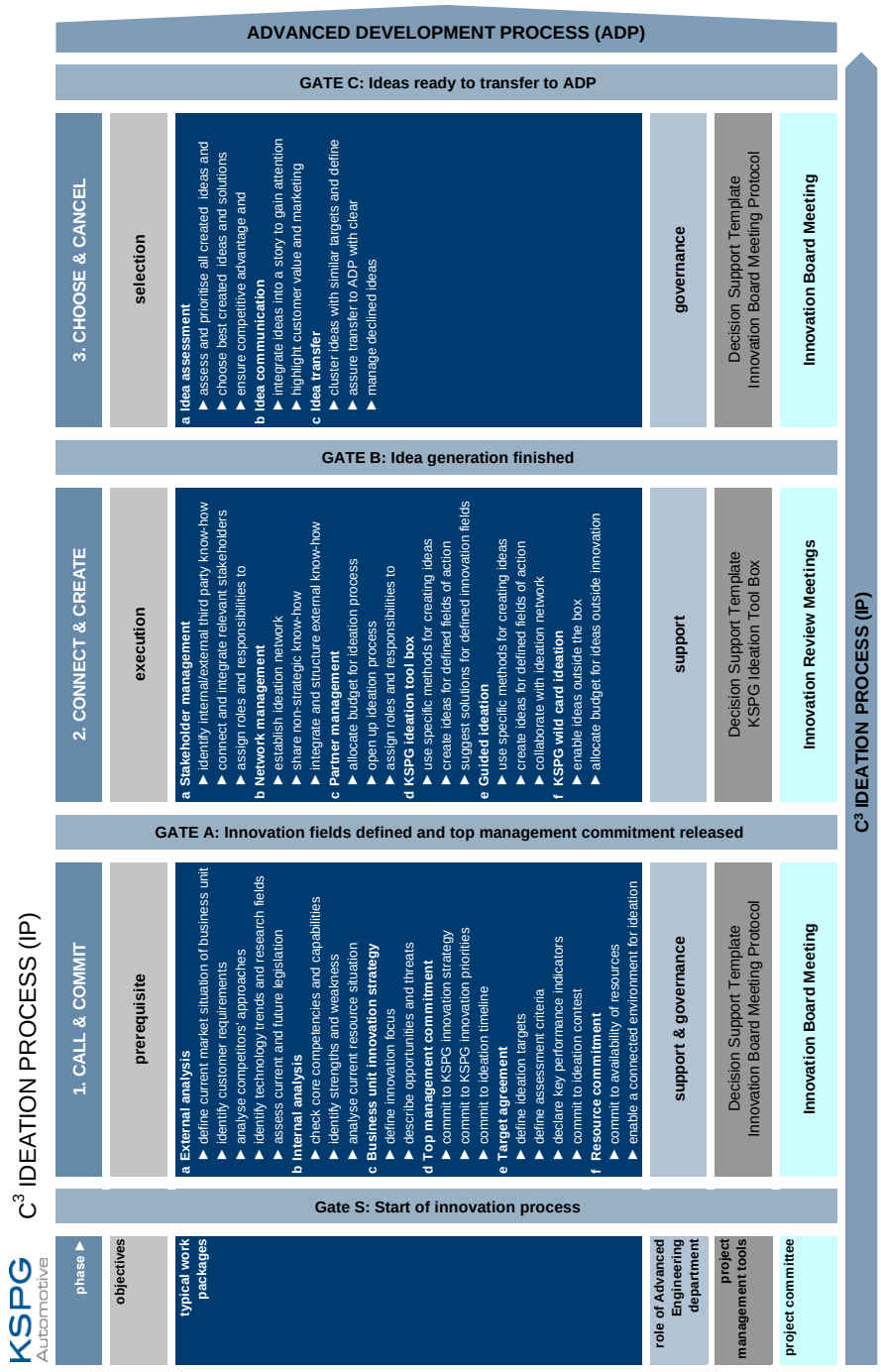

Figure 11 : Processus d'idéation pour KSPG AG

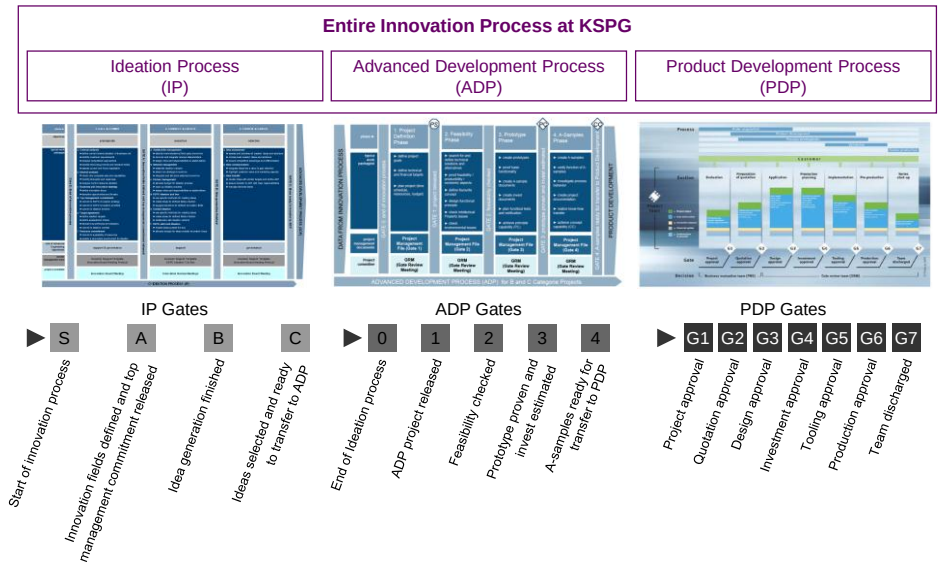

Figure 12 : Processus d'idéation dans le processus d'innovation de KSPG AG

La validation à grande échelle se fera à partir d'automne 2012 quand la campagne d'idées pour les nouveaux produits et services, ainsi que l'amélioration des produits existants qui sera lancée au niveau de toute l'organisation.

8 Bilan des apports pour la recherche académique

Nous avons réussi à combler le trou qui existait entre la recherche sur la créativité pour la génération des idées et leur valorisation dans une organisation industrielle pilotée par des processus bien structurés. Ainsi nos travaux se situent au carrefour des sciences d'ingénieur, des sciences économiques, et des sciences sociales. La notion de l'idéation qui nourrit le processus de gestion de l'innovation est l'élément au centre de ce carrefour en faisant le lien entre les trois disciplines concernées.

Nous avons notamment établi un lien entre la recherche en NPD, en gestion de l'innovation et en idéation. Ceci dans un contexte industriel qui nous a amené à produire des résultats académiques qui sont directement applicables aux contextes industriels. Ces résultats, comprenant un cadre générique et des instructions et lignes directrices pour le remplir, sont suffisamment génériques pour pouvoir être valorisés dans un environnement économique spécifique. Ils ont donc le potentiel de donner lieu à de nombreux projets de recherche et de validation dans une multitude de contextes différentes.

9 Bilan des apports pour l'application industrielle

Les facteurs de succès d'idéation et le processus de référence d'idéation que nous avons établis facilitent pour les entreprises la construction par eux-mêmes d'un processus de gestion d'idées, bien adapté à leurs besoins et leurs spécificités d'organisation et de culture. Ils donnent aussi des outils précieux pour des experts consultants qui accompagnent les entreprises au long du chemin dès l'identification des besoins, la conception du processus spécifique, son implémentation, évaluation et amélioration. Ceci présente une aide fondamentale pour un projet qui implique à la fois la mise en fonctionnement d'un nouveau processus, et le changement de culture d'innovation.

Nos résultats donnent également une base solide pour la collecte régulière des retours d'expérience pour bâtir une base de connaissance sur les valeurs qui intéressent les industriels, telles que

- les efforts requis pour les différentes phases d'introduction du processus et leur durée,
- la durée de chaque étape du processus,
- les investissements,
- les taux d'amélioration faisables avec le temps,
- etc.

10 Perspectives pour la recherche académique

10.1 Evaluation du processus de la phase floue amont

Nous considérons le potentiel de cette recherche très important, notamment car il y a peu de travaux comparables qui s'occupent de la phase amont du processus d'innovation. Dans la littérature, cette phase de la naissance et de maturation est considérée comme la phase floue amont de l'innovation, dû au fait qu'elle se passe de manière peu, voire pas, gérable dans les entreprises. Après évaluation, les idées issues de cette phase entrent dans une chaine de différents processus bien spécifiés, que les dirigeants savent bien gérer, et qui génèrent les indicateurs de performance en innovation de l'entreprise. Sous la pression d'un besoin d'innovation fortement croissant, les grandes entreprises réalisent la valeur de cette phase amont pour « nourrir » ces processus avec des idées qui peuvent être transformées en innovation. Les dirigeants cherchent donc des moyens qui leur permettent de gérer cette phase de manière similaire

aux autres phases d'innovation. Pour pouvoir gérer ce processus, il est nécessaire

- de structurer cette phase pour qu'elle se déroule selon un processus bien défini,
- de définir des indicateurs qui permettent d'évaluer sa performance, ainsi que
- les mesures et outils requis pour pouvoir évaluer ces indicateurs.

Or, la plupart des indicateurs utilisés à ce jour pour évaluer la performance en innovation d'entreprise ne sont pas appropriés à donner une mesure fiable et utile pour pouvoir gérer et améliorer le processus de génération et maturation d'idées. Il faut donc rechercher d'autres indicateurs, et valider leurs aptitudes. En outre, la structuration de la phase de la création d'idées posera plusieurs autres nouvelles questions de recherche :

1) Dans quelle mesure peut-on « forcer » la phase la plus créative dans une structure sans restreindre la créativité, au contraire l'augmenter ?
2) Comment peut-on mesurer l'impact de chaque étape de processus à la création d'idées ?
3) Quels sont les outils les plus aptes à soutenir les acteurs dans chaque étape ?
4) Quelles sont les critères qui permettent de bien estimer le temps et l'effort qu'il faut pour faire vivre le processus dans une organisation particulière ?

10.2 Intégration des acteurs

Dans le cadre de cette thèse nous avons identifié que certaines méthodes de management d'idées ont été établies pour gérer les idées d'amélioration des processus internes dans le cadre des efforts pour l'amélioration continue. Or typiquement, les idées pour de nouveaux produits et services de l'entreprise ne sont pas traitées par ces méthodes qui s'adressent ouvertement à tous les employées. Au contraire, l'innovation est considérée comme sujet de quelques employés seulement, ceux-ci souvent dans des positions dirigeantes. Le sujet au cœur de la thèse est l'hypothèse que l'intégration de différents experts dans le processus d'innovation, et plus particulièrement dans la création et évaluation idées, doit contribuer de manière significative à l'augmentation du nombre, de la « qualité » et de la pertinence des idées reçues. Dû aux contraintes de l'entreprise et du temps qu'il faut pour faire vivre un nouveau processus dans une grande organisation, nous n'avons pu valider cette hypothèse qu'à petite échelle. On devrait donc lancer des projets de recherche comparables dans

plusieurs entreprises, les accompagner et les instrumentaliser afin de pouvoir en tirer des statistiques permettant d'évaluer de manière quantitative l'effet de l'intégration de différents experts.

En outre, nous pensons que ces effets jouent aussi un rôle significatif dans la durabilité des innovations issues des idées crées, évaluées et développées par des acteurs qui interviennent dans plusieurs phases différentes du cycle de vie du produit. Car notamment grâce à leurs expériences et points de vue différents, ils peuvent aider à assurer que les idées et leurs réalisations remplissent le mieux possible les critères qui sont décisifs pour leur succès. Cette question nous amène directement à l'innovation ouverte, un des sujets actuels phares de la recherche en innovation : on peut s'imaginer que des acteurs extérieurs de l'organisation interne de l'entreprise participent eux aussi à la création et évaluation des idées. Nous pensons notamment aux clients, fournisseurs, et aux partenaires de recherche et développement. Même les compétiteurs et les expériences de leurs clients avec leurs produits peuvent être une source intéressante pour de nouvelles idées. Pour en profiter, il faut trouver une façon de les intégrer dans le processus de création d'idées sans mettre en danger la compétitivité et la confidentialité.

10.3 Evaluation d'idées

Afin de ne pas restreindre la créativité des acteurs concernés, il faut considérer toute idée comme bonne et pertinente pour un sujet défini au départ du processus. Pourtant, suivant le budget disponible, il faudra prioriser les idées qui ont le plus grand potentiel pour faire le sujet d'une innovation, sans pour autant perdre les autres. Par conséquence, il est nécessaire de définir et communiquer les critères d'évaluation des idées en amont. Or, quels sont ces critères ? Est-ce qu'il y a d'autres mesures que le chiffre d'affaires que l'innovation issue d'une idée pourra apporter ? Sont cherchés les mesures et indicateurs qui permettent d'évaluer le potentiel d'une idée pour de nombreux point de vue tels que marché, organisation, image de marque, vue long terme, stratégie de l'entreprise etc. Il faut aussi donner aux acteurs les moyens et outils pour calculer ces indicateurs et pouvoir les représenter de manière apte pour les décideurs. Nous avons vu qu'il y a de nombreuses idées qui meurent faute de connaissance et d'utilisation de ces dernières.

10.4 Facteurs clés de succès

On devra aussi sans doute mener une enquête approfondie par rapport aux méthodes et facteurs clés de gestion d'idées appliqués par les entreprises innovantes de différents secteurs. Nous avons commencé une telle enquête dans le cadre de la thèse, mais à petite échelle et avec un focus sur les entreprises

allemandes du secteur automobile. Je considère l'identification de ces facteurs de succès indispensable pour concevoir et mettre en œuvre un processus de création d'idées qui prenne en compte toutes les spécificités de l'entreprise ciblée. La conception d'un processus spécifique au contexte autour de ces facteurs permettra d'éviter de copier un processus d'une entreprise à l'autre, ce qui comporte des risques d'échec graves. Dû à la confidentialité de ce sujet, peu de choses ont été publiées. Par conséquence, une approche basée sur les entrevues d'experts me semble la plus adaptée à cette problématique. Grâce à la « neutralité » des doctorants leur donnant un accès plus facile aux responsables d'innovation, ceci pourrait bien se faire dans le cadre d'une ou plusieurs nouvelles thèses.

10.5 Influences culturelles

Comme nous je l'ai expliqué dans l'introduction de ce projet de recherche, le contexte du projet nous a amené à investiguer une approche à l'idéation pilotée par un processus clairement structurée et supportée par de outils bien définis et approuvés. Dans les sciences sociales et les sciences de management d'entreprise il est bien connu qu'il y a d'autres approches à l'idéation et la gestion de l'innovation qui sont nettement moins structurées. Globalement, on constate que ces approches sociales sont courantes dans les pays orientaux, alors que les approches structurées selon le modèle des « étapes – points de décision » sont caractéristiques pour les pays occidentaux [GAU2007].

Il serait intéressant d'investiguer la validité des facteurs clés de l'idéation identifiés et de trouver de bons moyens et de bonnes recettes pour implémenter ces facteurs dans des organisations qui ne sont pas ou peu pilotées par des processus. Est-ce possible ? Est-ce nécessaire ? Comment le pendant du processus de référence pourrait-il se présenter ? Quels sont ses apports, ses valeurs ajoutées ?

Là aussi, il faudra ensuite se poser la question des bons indicateurs et outils d'évaluation de ces derniers.

11 Perspectives pour l'application industrielle

11.1 Suivi intégral de l'introduction et application du processus

Le processus d'idéation proposé doit être mis en œuvre dans une organisation donnée comme une boucle de régulation. On ne connaitra le bon fonctionnement du système commandé et de toute la boucle qu'après ils aient

été implémentés en intégralité, et après quelques boucles de marche. Or, la mise en marche de cette boucle est un processus plus ou moins longue et intensif en investissions financières et ressources humaines.

Il est donc absolument nécessaire de suivre et – tant que c'est souhaité par le management – accompagner l'entreprise sur le chemin d'introduction du processus, en observant l'évolution de la performance d'idéation et les indicateurs concernés, ainsi qu'en ajustant les paramètres du processus pour le contrôler et l'optimiser. Il faut en faire plusieurs expériences pour arriver aux estimations fondées des coûts, des efforts, et problèmes typiques qui peuvent être entrainés, connaissances essentiellement importantes pour les décideurs.

C'est l'étape qui succédera directement nos travaux de recherche et conseil chez cette entreprise. Nous aurons un rôle clé dans ce projet, nous permettant de contribuer nous-mêmes à la validation et amélioration des résultats de notre recherche.

11.2 Application aux différents secteurs industriels

Tandis que nous avons menés nos travaux dans l'environnement d'un sous-traitant de l'industrie automobile, nous avons opté pour des résultats qui soient applicables avec succès dans d'autres secteurs. La méthodologie que nous avons choisie en fait la preuve. Pourtant, nous n'avons pas encore eu ni l'occasion ni les moyens pour appliquer notre approche aux autres entreprises, ceci donnant lieu à un défi en complément de futures travaux de recherche. Avant tout, l'on devrait vérifier si les facteurs clés du succès d'idéation tels que nous les avons définis sont aussi pertinents dans des secteurs autres que l'automobile, et s'il y a d'autres facteurs à prendre en compte.

On pourrait envisager la proposition des facteurs secondaires ou lignes directrices par secteur industriel, qui aideraient à la dérivation d'une incarnation du processus d'idéation de référence pour une entreprise d'un secteur spécifique.

Le top management d'une autre entreprise mondiale hors secteur automobile s'intéresse déjà sérieusement à l'implémentation de notre processus d'idéation chez eux.

Résumé

Sous la pression croissante de l'innovation, les entreprises sont plus que jamais obligées de s'occuper de la gestion de l'innovation, et plus particulièrement la génération systématique et la sélection des idées. Ceci s'applique en particulier aux secteurs technologiques tels que l'automobile.

L'idéation signifie la procédure de la génération et sélection des idées pour les innovations de nouveaux produits, services où modèles d'affaires avec un potentiel commercial sur le marché. Elle se situe au début de la phase floue amont (« fuzzy front-end », FFE) du processus de l'innovation et détermine le processus de développement de nouveaux produits (« New Product Development », NPD).

Dans ce contexte, cette thèse vise à répondre à la question de recherche suivante: « Comment est-il possible de créer une approche structurée qui fait de l'idéation la tâche principale de la FFE et l'implémenter comme processus dans un environnement d'entreprise pour faciliter la gestion de l'innovation? » À cet objectif, la principale contribution de ce travail est un modèle « étape – points de décision » (« stage-gate » en anglais) d'un processus d'idéation de référence qui est basé sur un ensemble des facteurs clés de succès identifiés dans la littérature et des entrevues d'experts.

Le modèle de processus d'idéation de référence proposé s'appuie sur l'intégration forte et systématique des acteurs internes et externes dans l'idéation et intègre ainsi intrinsèquement le paradigme modern de l'Innovation Ouverte. Il a été conçu de manière qu'il puisse être intégré dans les processus d'innovation existants avec des efforts raisonnables, et qu'il assure l'alignement des activités d'idéation avec la stratégie commerciale de l'entreprise.

La validation du modèle de processus de référence proposé a été faite chez le sous-traitant automobile allemand KSPG Automotive Group essentiellement par la dérivation d'un processus spécifique à cette entreprise à partir du processus de référence. Ce processus dérivé prend en compte le contexte spécifique de l'innovation et l'idéation chez cette entreprise et facilite par conséquence son intégration dans la culture organisationnelle de l'entreprise et son paysage de processus.

Dans le cadre de cette thèse, la faisabilité de l'approche globale ainsi que le processus d'idéation lui-même ont été validés, et un concept pour l'introduction du nouveau processus a été établi. Sur cette base solide sont données des perspectives pour les prochaines activités de recherche qui sont directement liées à l'introduction et l'amélioration du processus, ainsi que la détermination de l'applicabilité de l'approche dans d'autres secteurs industriels.

Abstract

Under the rapidly increasing innovation pressure, companies are forced—more than ever before—to deal with the subject of innovation management, particularly with systematic idea generation and selection. This is especially true in technology-driven sectors such as automotive.

Ideation denotes the procedure of idea generation and selection for innovations of products, services or business models with commercialisation potential on the market. It is located in the very beginning of the fuzzy front-end (FFE) of the entire innovation process and sets the course for New Product Development (NPD).

In this context, this work attempts to answer the following research question: "How is it possible to create a structured approach which makes ideation the core task of the FFE, and to implement it as a process in a corporate environment such that it facilitates innovation management?" To this aim, its principal contribution is an ideation stage-gate reference process model based on a set of key success factors identified from literature and expert interviews.

The proposed ideation reference process model capitalises on the strong and systematic involvement of internal and external stakeholders in ideation, and therefore follows intrinsically the modern paradigm of Open Innovation. It is designed in a way that can be integrated in existing innovation processes with reasonable effort, and it assures the alignment of ideation activities with the company's business strategy.

The validation of the proposed reference process model has been done at the German automotive supplier KSPG Automotive Group based on the derivation of a company-specific ideation process from the reference process. This derived process takes into account the company's specific context of innovation and ideation, and is consequently focused on facilitating its integration into the company's organisational culture and process landscape while introducing a fundamentally new approach to systematic ideation activities.

In the scope of this thesis, the feasibility of the total approach as well as the ideation process itself has been demonstrated, and a concept for the broad introduction of the new process has been established. On this solid basis, perspectives for future research activities directly linked to the introduction and the improvement of the process, as well as to the determination of the applicability of the approach in different industry sectors are given.